APPENDIX C3

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

KEURIG, INC., Plaintiff, v. HON. DAVID J. KAPPOS, Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office, Defendant.	CIVIL ACTION NO. 09-2353 (BAH) ECF

RULE 26(A)(2)(B) EXPERT REPORT OF PROFESSOR ALEXANDER SLOCUM
JULY 8, 2011

PROTECTED – CONFIDENTIAL

I. INTRODUCTION

A. Qualifications and Other Preliminary Matters

1. I am a professor of Mechanical Engineering at the Massachusetts Institute of Technology. I have worked in the mechanical, civil, and precision engineering fields since 1985, when I received a Ph.D. in mechanical engineering from MIT. I have taught courses on mechanical design continuously since 1991. I regularly consult for companies to assist them with various types of design challenges. I am a named inventor on approximately 70 U.S. patents.

2. I graduated from the Massachusetts Institute of Technology in 1982 with a Bachelor's of Science degree in Mechanical Engineering. I obtained my S.M. in Mechanical Engineering from MIT in 1983, and received my Doctor of Science degree from MIT in 1985. My doctoral thesis was entitled "Sensor System Design to Determine Position and Orientation of Articulated Structures."

3. After receiving my Doctorate in 1985, I came to MIT as an Assistant Professor in Civil Engineering, teaching courses in construction automation and machine design. From 1989 to 1990, I was a Visiting Professor at the Cranfield Institute of Technology in Cranfield, United Kingdom.

4. I returned to MIT in 1991 as an Assistant Professor, this time in the Mechanical Engineering Department. I continued to teach courses on mechanical engineering and machine design. I became an Associate Professor in 1992, a tenured Associate Professor in 1995, and a Professor in 1998.

5. I have written two books on machine design, as well as a section of another book, and over 200 papers published in refereed journals and proceedings of refereed conferences. Exhibit A is a current copy of my Curriculum Vitae, which includes a complete list of my publications, including but not limited to those from the last ten years.

6. I have extensive experience designing hydraulic systems and developing the necessary seals so as to contain fluids. For example, I developed abrasive waterjet technology that allows for quick and affordable precision cutting in machine shops. This technology has been commercialized by OMAX Corporation as the OMAX Jet Machining Center.

7. I have served on numerous advisory and review panels and professional committees, as set forth in my Curriculum Vitae. I also frequently consult for industry on the development of new products of various kinds. I was recently retained by the United States Department of Energy Secretary, Dr. Steven Chu, to be a member of his special team of experts working on the Deepwater Horizon oil leak in the Gulf of Mexico.

8. I have been awarded Society of Mechanical Engineers Prizes for outstanding contributions to various fields related to mechanical engineering and manufacturing three times, twice in 1986 and once in 1993. In 1994, I received the American Society of Civil Engineers Thomas Fitch Rowland Prize. I was also awarded the 1997 Society of Mechanical Engineers Frederick W. Taylor Research Medal, the 2000 Massachusetts Professor of the Year Award, the 2004 American Society of Mechanical Engineers Leonardo da Vinci Award, the ASME Machine Design Award in 2008, the M.I.T. 100K Business Plan Competition for Robopsy (see Robopsy.com), as well as 11 R&D 100 Awards for Best New Scientific and Technical Products as determined by R&D Magazine. A full list of my awards is provided in my Curriculum Vitae.

9. Exhibit B is a list of cases in which I have been retained as an expert. In some of those cases I have provided deposition and/or trial testimony, as indicated.

10. I am being compensated for the time I spend on this matter at my standard consulting rate of $500/hour. My compensation is not in any way dependent on the outcome of this litigation.

B. What I Have Been Asked to Evaluate

11. Lawyers for Keurig asked me to evaluate a number of questions related to U.S. Patent Application No. 10/658,925, which I will refer to as "the '925 application" or informally as Keurig's "fluted-filter patent application."[1]

12. Based on discussions with the lawyers along with my review of various documents, I understand that the United States Patent & Trademark Office ("USPTO") has rejected claims 1-9, 12-19, and 22-44 of Keurig's '925 application. I understand the USPTO's theory to be that it would have been "obvious" to make the products described in claims 1-9, 12-19, and 22-44. Specifically, the USPTO appears to believe that it would have been obvious as of September 10, 2003 (the filing date of Keurig's fluted-filter patent application) to begin with the beverage filter cartridge described in U.S. Patent No. 5,325,765 ("Sylvan") and replace the smooth filter illustrated in Sylvan with a fluted filter as shown in U.S. Patent Publication No. 2002/0185010 ("Spiteri").[2]

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[1] I recognize that some of the claims in the patent actually concern filters with "pleats" or "corrugations" as an alternative to flutes.

[2] I realize that the USPTO relied on certain references when rejecting certain claims. However, combining Sylvan with Spiteri was an essential aspect of the USPTO's analysis even for these claims.

13. Keurig's lawyers have asked me to evaluate the USPTO's theory in the course of conducting my own analysis to determine whether or not claims 1-9, 12-19, and 22-44 of Keurig's '925 application would have been obvious.

14. Keurig's lawyers have explained to me that determining whether or not a patent claim would have been obvious requires considering at minimum (1) the identity of the applicable prior art as well as what it discloses, (2) the differences between what the prior art discloses and what the patent claim covers, and (3) the degree of skill possessed by typical people in the field. I therefore evaluated each one of these factors. As described below, my analysis leads me to conclude that claims 1-9, 12-19, and 22-44 of Keurig's '925 application would <u>not</u> have been obvious to someone skilled in the art as of September 2003. In particular, I conclude that there are various reasons why typical artisans would have <u>rejected</u> the idea of modifying Sylvan's beverage cartridge by replacing the smooth filter illustrated in Sylvan itself with a fluted filter as shown in Spiteri. These reasons include (1) concerns about forming a durable seal between Spiteri's fluted filter and the sides of Sylvan's cartridges (as is required for a pressurized coffee-making system such as Sylvan discloses), (2) difficulty manufacturing the fluted filters themselves in a way suitable for mass production of the beverage filter cartridges as a whole, and (3) specific teachings in Sylvan that contradict those in Spiteri.

15. I understand that certain "objective" pieces of evidence may also suggest non-obviousness, such as whether products covered by the claims achieved "commercial success" as a result of benefits that the invention provided beyond that was available in the prior art. I have not considered these issues. For one, my analysis of the factors discussed in the preceding paragraph (i.e., even without consideration of factors such as commercial success) led me to the

firm conclusion that the inventions described in claims 1-9, 12-19, and 22-44 of Keurig's '925 application would not have been obvious. Second, I am not a marketing expert.[3]

16. I have reviewed the following materials in the course of my work on this case:

- Sylvan (U.S. Patent No. 5,325,765) (K000589-596)
- Daswick (U.S. Patent No. 3,971,305) (K000456-462)
- Michielsen (U.S. Patent No. 3,389,650) (K000452-455)
- Spiteri (U.S. Patent Application Publication No. 2002/0185010) (K00582-588)
- Lesser (U.S. Patent No. 6,007,853) (K103493-505)
- Sweeney (U.S. Patent No. 6,645,537) (K000443-451)
- Sweeney (U.S. Patent Publication No. 2002/0020659) (K103506-515)
- Tanner (U.S. Patent No. 6,602,410) (K103523-539)
- Frise (PCT Publication No. WO 91/14389) (K000796-808)
- Lazaris (U.S. Patent No. 6,589,577) (K103486-492)
- Barnes (U.S. Patent No. 6,623,236)
- File History for the '925 application (K000606-1141),including but not limited to:
    - Patent Application of Basil Karanikos and Frederick Rossi for Beverage Filter Cartridge (K000618-624)
    - July 2006 Amendment in Response to Non-Final Office Action (K000781-791)
    - December 2006 Amendment in Response to Non-Final Office Action (K000823-834)
    - December 2006 Amendment
    - August 2007 Office Action (K000883-890)
    - January 2008 Office Action (K000908-918)
    - Examiner's Answer in Response to Appeal Brief (K001058-1070)
    - Decision on Appeal to Board of Patent Appeals & Interferences (K001092-1111)
    - Decision on Request for Rehearing (K001133-41)
- License and Distribution Agreement between Keurig, Incorporated and Tully's Coffee Corporation (K000463-523)
- Keurig Update, May 7, 2004 (K000213-227)
- Board of Directors Update 12/10/03 At Home Division (K075483-88)
- Ted R. Lingle, The Coffee Brewing Handbook (Specialty Coffee Association of America, 1996) (K104533-97)
- Discussion with Mr. Ted Lingle, Executive Director of the Coffee Quality Institute ("CQI")
- Discussion with REDACTED
- Discussion with Mr. Kevin Sullivan, Keurig Vice President of Engineering

[3] Keurig's lawyers did ask me to determine whether certain of Keurig's fluted-filter patent claims cover the current design of Keurig's K-Cups and then discuss my conclusions with Professor John Stanton, who I understand is an expert in food and beverage marketing issues.

17. My testimony may include the use of exhibits and demonstrations, which I will prepare in a time frame consistent with any scheduling orders of the Court. In support of my opinions, I may also refer to any of the documents produced by the parties in discovery and/or industry or technical publications, and particularly those documents referred to in the body of this report or in any exhibit hereto. If additional documents come to light at a later time, I reserve the right to address those as well.

II. FACTUAL ASSESSMENTS UNDERLYING MY CONCLUSIONS

18. As noted above, I understand from Keurig's lawyers that determining whether or not any patent claim would have been obvious at the time it was invented requires determining (1) the identity of the applicable prior art as well as what it discloses, (2) the differences between what the prior art discloses and what the patent claim covers, and (3) the degree of skill possessed by typical people in the field at the time of the invention. This section of my report separately assesses each one of these three considerations. It also details the execution and results of a series of experiments that I conceived so as to provide an objective sense of both the nature of the prior art and how it differed from the invention claimed in the '925 application.

A. Scope and Content of the Prior Art

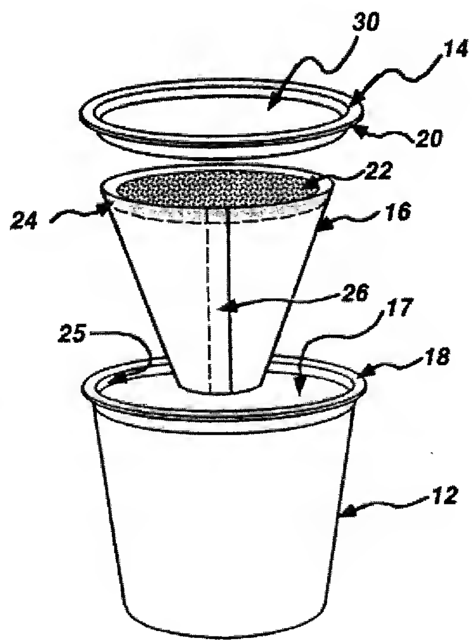
19. In order to assess the identity of the applicable prior art and what it discloses, I have carefully reviewed all of the "evidence relied upon" in the USPTO Examiner's Answer Before the Board of Patent Appeals and Interferences ("BPAI"):

1) Sylvan (U.S. Patent No. 5,325,765)
2) Daswick (U.S. Patent No. 3,971,305)
3) Michielsen (U.S. Patent No. 3,389,650)
4) Spiteri (U.S. Patent Application Publication No. 2002/0185010)

(K001058-1070 at pp. 3-4). These are also the only materials on which the BPAI relied when affirming the Examiner's rejection of claims 1-9, 12-19, and 22-44. I discuss each below.

1. Sylvan

20. Sylvan describes a single-serve beverage cartridge with a base and a "filter element…sealingly engaged with the opening of the base" which "divides the base into two sealed chambers." (Col. 2, lines 10-16). Figure 1 in Sylvan depicts the filter [16], base [12] and the portions of the filter [24] and base [25] where the two are sealed together. (Col. 3, lines 56-58).



21. Unlike familiar drip-brew products, Sylvan discloses a system in which *pressurized* hot water (e.g., Col. 4, lines 23-24) is injected into a sealed cartridge that contains two chambers separated by a filter [16], as depicted above. The pressurized water permeates coffee [22] in the brewing chamber, passes through the filter, and enters the second chamber.

For example, claim 1 requires that the filter subdivide the cartridge into two chambers and be "adapted to accommodate passage therethrough of said beverage" into the second chamber.

22. The brewing process disclosed in Sylvan differs from conventional "drip-brewing" techniques in that it requires injecting pressurized water into the brewing chamber. This pressurized environment increases the risk that the filter will collapse against the inner walls of the cartridge base, thereby obstructing flow and interfering with the brew process.

23. Sylvan solved this problem by using rigid material (e.g., incorporating PVC or polypropylene) for the filter while suspending it from the lip or rim of the cartridge itself. Thus, Sylvan's "self-supporting" filter does not sag or collapse when wetted. (E.g., Col. 2, lines 8-12 and Col. 3, lines 2-10 & 56-58).

24. In addition, Sylvan discloses a filter that is smaller than the base so that it diverges from the inner walls of the cartridge. By avoiding contact with the walls, the Sylvan cartridge ensures the walls do not impede the filtering function. (Col. 2, lines 13-16 and Col. 4, lines 1-6).

2. <u>Spiteri</u>

25. Spiteri describes a filter designed for use in a "conventional coffee brewer means such as an electric drip brewer." The Spiteri filter has walls that can "be folded together in a flat configuration," but is also "self-supporting" when unfolded and wetted. (Para. 7). By remaining upright during brewing, the Spiteri filter is designed to prevent unwanted coffee grounds from spilling over the filter and into the brewed coffee below. (Paras. 1 and 2). It also prevents water from bypassing the grounds and diluting the final product. (Paras. 1 and 3).

26. Unlike the Sylvan filter, which was sealed to, and suspended within a cartridge, the Spiteri filter was designed to be "stood on the inside of a vessel such as a coffee basket."

(Para. 5). Thus, Spiteri's free-standing filter derives its "self-supporting" aspect and its resistance to collapse from pleats. By contrast, the "self-supporting" character of Sylvan's filter is based upon it being sealed to and suspended within the cartridge.

27. Spiteri also differs from Sylvan in that its radially-expanding filter naturally makes contact with the walls of the brew basket in which it is unfolded. Indeed, wall contact in Spiteri prevents the filter from collapsing. By contrast, Sylvan discourages wall contact because it blocks filter flow, and hence Spiteri teaches away from Sylvan. In addition, the hot water is dripped onto the top of the coffee held by Spiteri's filter and then seeps downward to the bottom of the coffee basket where it flows out a central hole and into the carafe or other receptacle. There is no appreciable radial flow.

3. <u>Michielsen</u>

28. Michielsen discloses a coffee filter directed to "thc problem of supporting" the filter during use. (Col. 1, lines 28-31). Like Spiteri, Michielsen addresses the problem of keeping the filter in contact with a supporting wall. (Col. 1, lines 41-44 ("The first characteristic feature conforming to the present invention is that the envelope is so to say connected with the support by the hydrostatic pressure of the liquid medium which is placed on top.")).

29. Michielsen describes an envelope formed by two circular filter papers joined together and containing ground coffee. As depicted in Figures 3 and 4, the envelope [17] has a rigid side wall [18] and collar [19] that makes contact with the narrowing vessel walls [12].

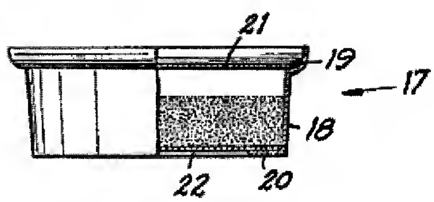


Fig.3

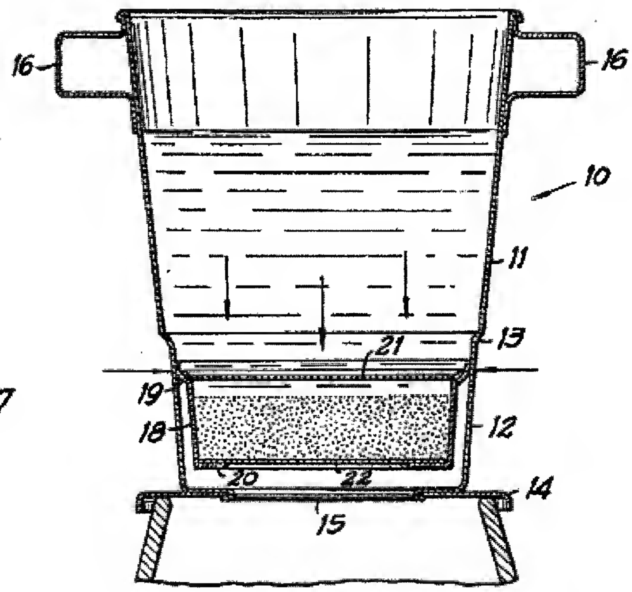


Fig.4

Thus, the envelope fits snugly within the bottom of a circular vessel such that, when water is poured into the vessel, the pressure of the water "ensures a systematic sealing" between the envelope and the inner walls of the vessel. (Col. 3, lines 34-38). As a result, "all the boiling water is necessarily expelled and forced to pass through aforesaid envelope." (Id.).

30. In another embodiment, pictured below, the envelope is attached to a brew vessel [2] that has pleated walls which are supported by a surrounding ring [1].

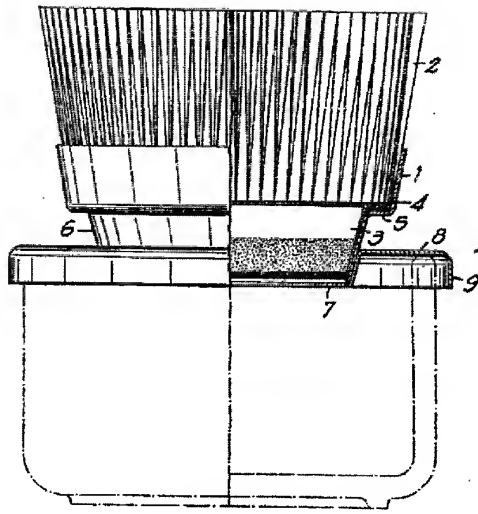


Fig. 1

4. Daswick

31. Daswick discloses a disposable apparatus for making a single cup of coffee with a filter designed to encourage slower brew times and even, efficient brewing. In particular, Daswick teaches the use of a water-diverting element to prevent water from being poured directly onto the coffee grounds, which can result in clogging the filter and uneven extraction of bitter flavors. Unlike the other references cited, there is no risk that water or coffee grounds will bypass the Daswick filter (through collapsing filter walls or a defective seal) because the filter [10] contains an upper portion [50] which extends above the upper edge [46] of a conical support [40] in which it is seated. (Col. 3, lines 46-60).

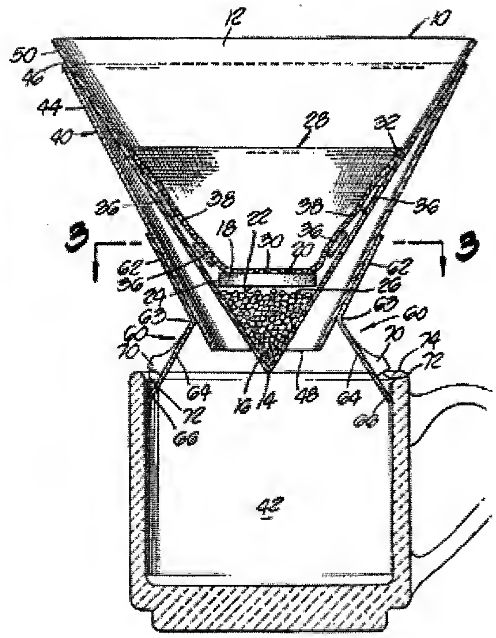


FIG. 2.

5. **Additional References**

32. I am aware that the USPTO initially cited a variety of references other than those that the Examiner discussed in his Answer and the BPAI later discussed in its opinion. These include the following:

- Lesser (U.S. Patent No. 6,007,853)
- Sweeney (U.S. Patent No. 6,645,537)
- Tanner (U.S. Patent No. 6,602,410)
- Frise (PCT Publication No. WO 91/14389)

33. I also understand that Keurig disclosed various addition references to the USPTO, including Lazaris (U.S. Patent No. 6,589,577).

34. For the most part, these materials do not appear to add anything of note beyond the content already disclosed in the Sylvan, Spiteri, Michielsen, and Daswick references that I addressed above.

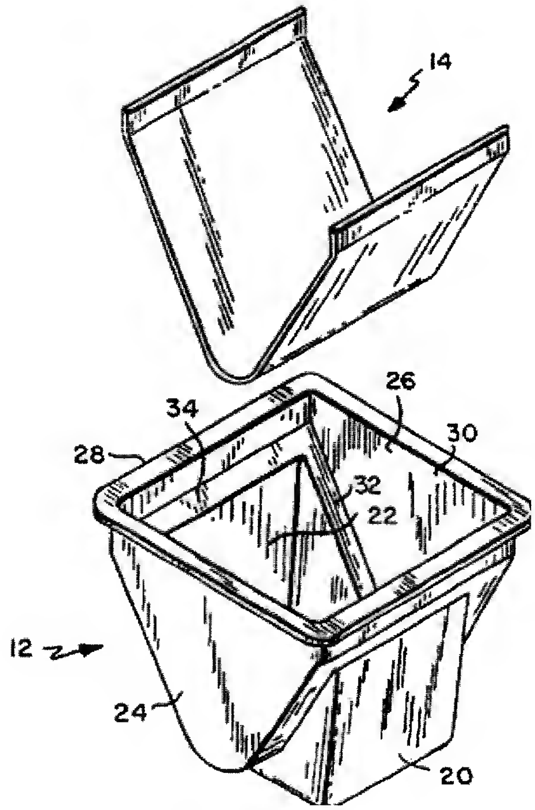
35. However, Sweeney and Lazaris merit special mention because they refer to Sylvan and discuss certain shortcomings with that earlier prior art.

36. In particular, Sweeney reports that problems had "been encountered in reliably sealing the rim of the filter component to the interior side wall of the container." (Col. 1, lines 47-48). This risked "the brewed beverage being contaminated by beverage medium residue escaping from the collapsed filter." (Col. 1, lines 50-54).

37. Likewise, Lazaris explains that the beverage filter cartridge disclosed in Sylvan has "certain problems and disadvantages relating to its production." (Col. 1, lines 30-32). Specifically, Lazaris describes manufacturing problems related to forming the filter and attaching it to the container:

> For example, expensive and mechanically complex production equipment is required both to form the cone-shaped filter from a sheet of filter media, and to insert and secure the thus formed filter cone in the cartridge container. Slight deviations from close tolerances governing these steps can cause the filter to rupture or become dislodged from the container wall during the brewing cycle, resulting in contamination of the brewed beverage with beverage medium residue from the first chamber.

(Col. 1, lines 35-43). In light of these problems, Lazaris substituted a planar filter to simplify filter formation and insertion. (Col. 2, lines 17-18). In addition, the Lazaris cartridge incorporated filter-supporting ledges to the container sides, which "offer ample support surfaces against which edge portions of the filter element may be reliably secured." (Col. 2, lines 20-21). Figure 2 of Lazaris depicts the planar filter and supporting ledges:



B. Differences Between the Claimed Invention and the Prior Art

38. Having considered what is disclosed in the prior art that the USPTO relied upon, I next assessed the differences between that prior art on the one hand and claims 1-9, 12-19, and 22-44 of Keurig's fluted-filter application on the other. I found that these differences are substantial.

39. While different in various respects, claims 1-9, 12-19, and 22-24 have certain core similarities. First, all require a filter element that both (1) is "directly joined" to the side walls of the cartridge and (2) serves to subdivide the cartridge into two chambers. Second, all require that the side of the filter element incorporate "pleats," "flutes," or "corrugations."

40. The application illustrates both of these concepts:

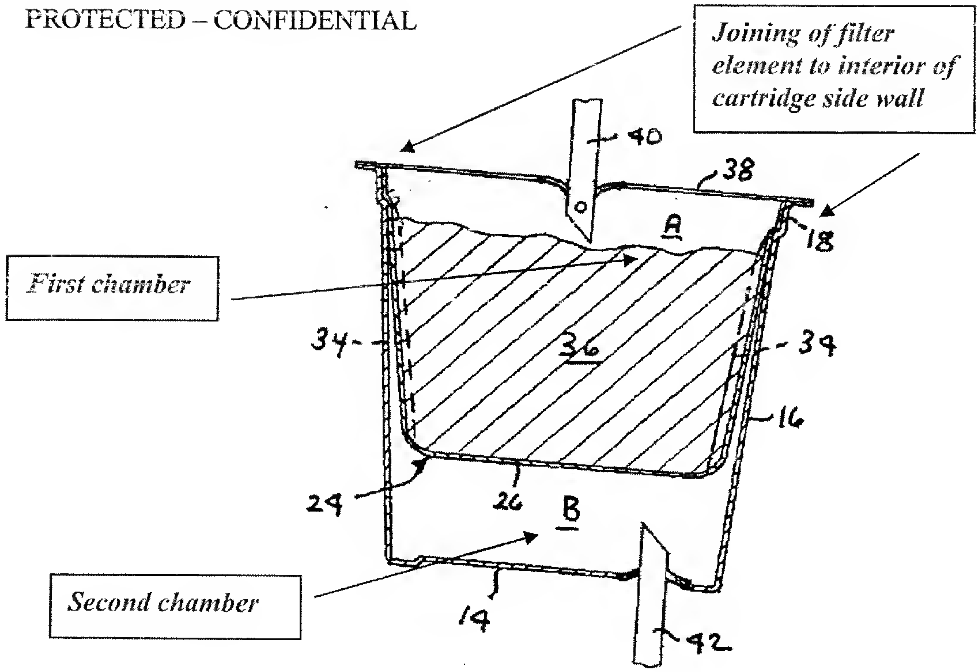
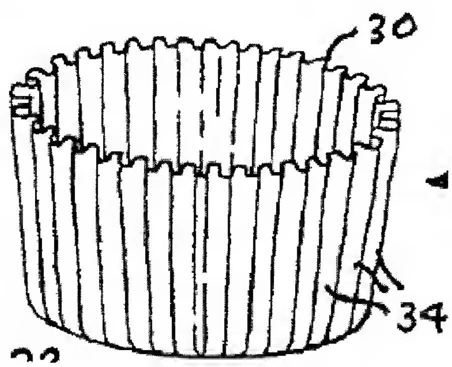
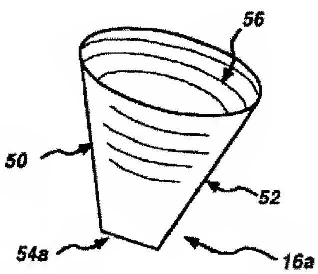

Joining of filter element to interior of cartridge side wall
40
38
A
18
First chamber
34
36
34
16
24
26
B
Second chamber
14
42

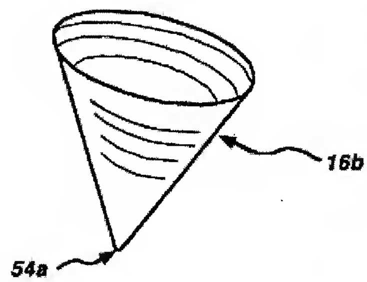
Fig. 8

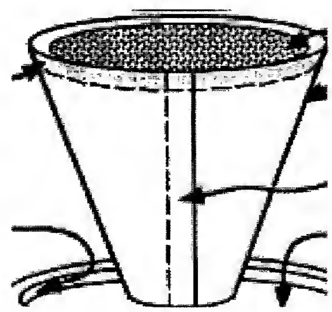

30
34

41. Sylvan was the only prior-art reference that the USPTO ever asserted during prosecution of the '925 application to disclose a filter element that both (1) is "directly joined" to the side walls of the cartridge[4] and (2) subdivides the cartridge into two chambers.

42. Yet nothing in Sylvan even hints at the possibility of using fluted, pleated, or corrugated filters.[5] Instead, Sylvan depicts various smooth-walled filters:







[4] In fact, I note that the USPTO Examiner suggested the addition of the "directly joined" language so as to distinguish the claims from Lesser. (July 11, 2006 Amendment in Response to Non-Final Office Action (K000781-791) at pp. 9-10). Lesser appears to be the only other "primary" reference (i.e., apart from Sylvan) on which the USPTO ever relied when maintaining that the '925 application claims would have been obvious. By "primary," I mean the reference that allegedly describes the majority of the claim elements, with a "secondary" reference allegedly teaching the rest.

[5] With that said, the actual claims in Sylvan do not specify any sort of parameters for the filter element. While I have not studied the Sylvan claims themselves in great detail, they appear to <u>cover</u> cartridges with fluted filters even though nothing in Sylvan as a whole suggests using this particular design. In my experience, it is typical for such "first-generation" patents to cover a wide range of territory even though they do not highlight particular features that ultimately prove critical for a commercially successful product. Instead, later generations of patents describe and claim such features. To take a very simple example, suppose that the inventor of the pencil had obtained a patent claiming "a writing instrument comprising a quantity of graphite surrounded by a layer of wood." If someone else later discovered that rubber can remove graphite from paper, that person could obtain a patent on a pencil with an eraser even though the original claim already covered such products.

43. While other prior art references (e.g., Spiteri and Michielsen) do concern fluted filters, they have nothing to do with enclosed cartridge systems having a filter that is directly joined to the sides of the cartridge and divides it into first and second chambers. In fact, nothing in either Spiteri or Michielsen (nor in Daswick for that matter) suggests anything at all about brewing coffee or other beverages using pressurized water as disclosed in Sylvan.

44. Both Spiteri and Michielsen instead describe designs for fluted or pleated filters that sit in the bottom of a conventional brew basket for drip brewing (e.g., Spiteri, Para. 5) and are designed to avoid the "sagging and drooping" often observed with filters in such situations. If the filter moves away from the sides of the brew basket, it opens a path for water to flow into the beverage pot without actually passing through the bed of ground coffee particles or other media inside the filter. As Spiteri notes, this weakens the brewed beverage. (Para. 3). A gap between the filter and the walls of the brew basket also risks having coffee grounds themselves contaminate the finished product. (Para. 2).

45. Sylvan's design – physically attaching the filter to the sides of the cartridge wall – avoids this problem so long as the seal itself retains integrity. If the filter remains attached to the cartridge, it will always be suspended between the coffee and water in the first chamber and the finished beverage in the second chamber. Nothing can pass from the first into the second without going through the filter.

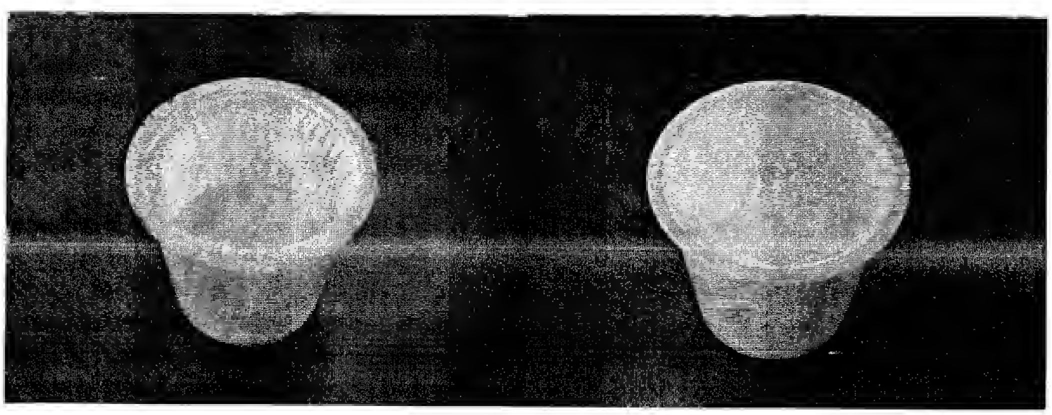
C. Experiments Assessing the Differences Between the <u>Claimed Invention and the Sylvan Prior Art</u>

46. I conceived and supervised a series of experiments to provide an objective sense of the differences between the Sylvan prior art and the invention claimed in the '925 application.

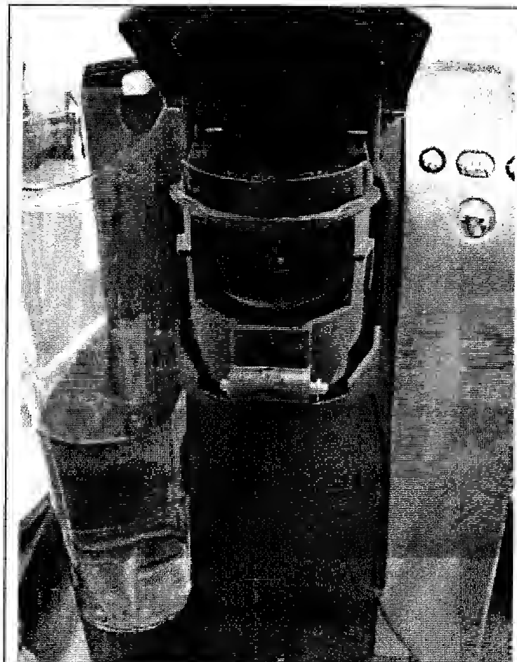
47. Specifically, I requested that Keurig personnel prepare one set of beverage-filter cartridges reflective of the actual production "K-Cup" portion packs that Keurig is now selling. I had carefully studied those cartridges, which have fluted filters, and compared them to all three independent claims of the '925 Application. Exhibit C reflects my analysis and provides an element-by-element comparison. I conclude that Keurig's K-Cup portion packs as currently sold are covered by all of the independent claims in the '925 Application. Thus, my request for production-style K-Cup portion packs was in essence a request for a set of beverage-filter cartridges covered by the '925 claims. For convenience, I will henceforth refer to these products as "fluted-filter" cartridges. I have provided an unfilled sample as SLOCUM0034.

48. I also requested that Keurig personnel prepare a second set of beverage-filter cartridges that were reflective of the products illustrated in Sylvan. For convenience, I will henceforth refer to these products as "conical-filter" cartridges. I have provided an unfilled sample as SLOCUM0035.

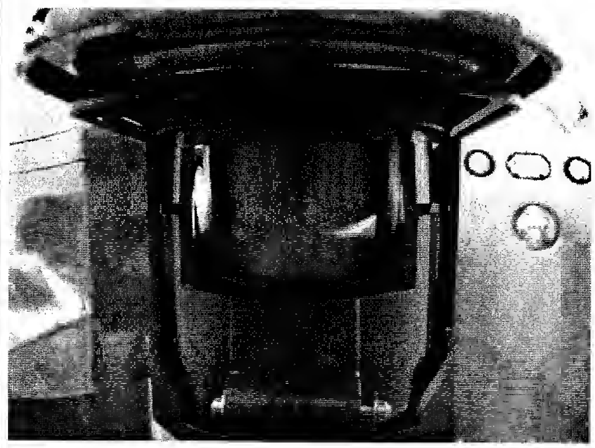
49. In both cases, I requested that the cartridges be made using translucent sidewalls, thereby facilitating visualization:



50. Along the same lines, I requested that a Keurig brewing machine be modified so as to remove the front wall of the brewing chamber, thereby permitting observation of the cartridge during brewing



Keurig B76 Brewer



Modified brewing chamber

51. With these supplies in hand, Keurig personnel performed a series of experiments under my direction and supervision. While certain parameters varied as detailed below, we used a standard protocol for measurements.

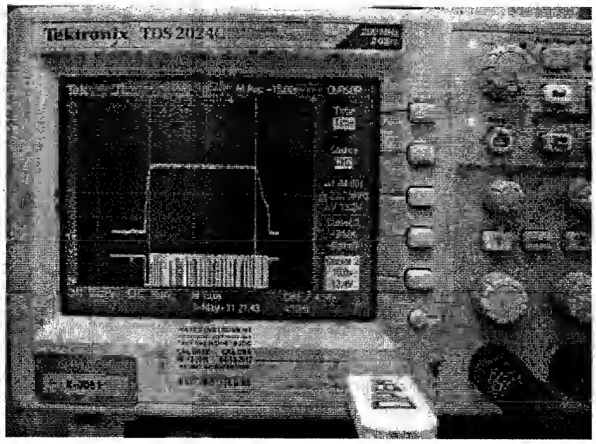
52. Prior to running a given brew cycle (i.e., putting a fluted-filter or conical-filter K-Cup portion pack in the modified brewer and selecting the desired serving size), we determined the mass of the K-Cup portion pack. We were thereby able to confirm the mass of the coffee itself by subtracting the appropriate tare value, which we separately measured.

53. Upon completion of each brew cycle, I directed that the product (i.e., cup of coffee) be massed and also that "total dissolved solids" (TDS) be measured using a coffee conductivity meter:

Based on discussions with Mr. Ted Lingle, Executive Director of the Coffee Quality Institute ("CQI"), I understand that this device constitutes the industry standard for determining TDS. We took a minimum of three readings for every sample, then recorded the average. We also recorded the baseline TDS value for the water that we used for the testing. By subtracting this figure (115) from the average of the total TDS readings, we determined the adjusted TDS for each sample.

54. We used the same type of coffee (Green Mountain Sumatran Reserve) in all cases to ensure that TDS values and other measurements could be compared across different runs.

55. I also directed that brew time be measured using an oscilloscope to identify when the brewer initiated and terminated the pressurized brew cycle (yellow line below).



Such an approach is significantly more precise than using a stopwatch or other such manual device.

56. Exhibit D reports the results of my experiments, which I describe in the following paragraphs and also document in the photographs and videos produced as SLOCUM0001-33.

1. <u>Experiment 1: Control and Validation</u>

57. For my first experiment, I wanted to assess whether the specially-constructed translucent K-Cup portion packs would yield results comparable to those seen with ostensibly identical production samples. I also wanted to get a sense of the range of TDS values that is achievable in the real world when using cartridges covered by the '925 application claims.

58. For those reasons, I requested that three 8 ounce cups of coffee be brewed using each of:

(a) "production" Sumatran Reserve cartridges for sale to customers; and

(b) translucent fluted-filter cartridges with 12.0 g of Sumatran Reserve

Samples have been produced as SLOCUM0036 and SLOCUM0037, respectively. I selected 12.0 grams per translucent K-Cup portion pack because I understand that 12.0 grams is the amount of Sumatran Reserve coffee that Green Mountain seeks to place in each cartridge when producing Sumatran Reserve K-Cup portion packs on a commercial basis.

59. As one can see in Exhibit D, the results were similar for both sets of runs. The production K-Cup portion packs on average had 11.8 grams of coffee and took an average of 36.7 seconds to brew. They yielded coffee with an average net TDS of 1212 ppm. The translucent cartridges each had 12.0 grams of coffee and took an average of 36.1 seconds to brew. The resultant coffee had an average net TDS of 1254 ppm. The increase in TDS likely reflects the greater amount of coffee in thc translucent cartridges.

2. Experiment 2: Fluted Filter Versus Conical Filter (8 Ounces)

60. For my second expcriment, I wanted to study the impact (if any) on brew time and TDS readings when shifting from conical-filter cartridges (as illustrated in Sylvan) to fluted-filter cartridges (as claimed in the '925 application) while holding all other inputs constant.

61. I therefore requested that ten 8 ounce cups of coffee be brewed using each of:

(a) ***translucent conical-filter cartridges with 9.5 g of Sumatran Reserve; and***

(b) ***translucent fluted-filter cartridges with 9.5 g of Sumatran Reserve***

Samples have been produced as SLOCUM0038 and SLOCUM0039, respectively.

62. As shown in Exhibit D, the conical-filter cartridges took an average of 35.1 seconds to brew, although there was a significant degree of variation among the ten samples – from 30.0 seconds all the way up to 43.2 seconds. The average net TDS was 944 ppm. The fluted-filter cartridges had an average brew time of 28.6 seconds, with significantly less variation. The average net TDS was 903 ppm.

3. Experiment 3: Increasing Volume to 12 Ounces

63. I designed my third set of experiments to compare the performance of conical-filter cartridges and fluted-filter cartridges when used to brew larger servings of coffee.

64. I requested that three 12 ounce cups of coffee be brewed using each of:

(a) translucent conical-filter cartridges with 9.5 g of Sumatran Reserve; and

(b) translucent fluted-filter cartridges with 12.0 g of Sumatran Reserve

These masses were selected to correspond to what I understand to be the maximum amount of coffee that can be packed into conical-filter K-Cup portion packs and fluted-filter K-Cup portion packs using standard manufacturing techniques.

65. As indicated in Exhibit D, the conical-filter cartridges took an average of 52.1 seconds to brew a finished product having an average TDS of 660 ppm. The fluted-filter cartridges, with significantly more coffee for the water to work through, took an average of 65.4 seconds to brew a finished product having an average TDS of 836 ppm.

D. Level of Ordinary Skill in the Art

66. I have also considered the degree of skill possessed by typical people in the field of developing beverage brewing systems.

67. In particular, I have consulted with Mr. Lingle, who I understand has decades of experience in the coffee industry. Mr. Lingle reports that the industry has historically been skeptical to technological innovation and instead predisposed to keep brewing coffee using the handful of conventional techniques that have been used for decades. This is consistent with my own experiences over the years with various low-quality drip brewing machines.

68. On the basis of my discussions with Mr. Lingle as well as my review of the materials listed above, I conclude that the level of ordinary skill in the art as of 2003 would have been quite modest, and consistent with that of someone who had either (1) a bachelor's degree in engineering or (2) at least a year of experience designing beverage brewing systems.

III. CONCLUSIONS AND EXPLANATIONS

69. Based on my factual assessments detailed in Part II above, I conclude that claims 1-9, 12-19, and 22-44 of Keurig's '925 application would not have been obvious to a person of ordinary skill in the art as of September 2003. In fact, I conclude that there are multiple reasons why such an artisan would have specifically rejected the idea of taking a cartridge that was separated into two chambers by a filter element directly joined to the cartridge walls (as illustrated in Sylvan) and then modifying it by using a fluted, pleated, or corrugated filter element (as illustrated in Spitieri, for instance):

a. Artisans would have been deterred by the difficulty of ensuring that a fluted, pleated, or corrugated filter was "sealingly engaged" with the inner rim of Sylvan's cartridge (see Col. 2, line 12 & Col, 3, lines 3 and 56-57) so as to remain attached during Sylvan's pressurized brewing process. Folds from the flutes, pleats, or corrugations create differing numbers of filter layers around the inner edge of the cartridge at the point where the filter is welded to the cartridge. That in turn further complicates the already-challenging task of ensuring an adequate seal. This task is critical to the overall Sylvan disclosure, however, as a deficient seal permits liquid to bypass the grounds and may also allow errant grounds to pass into the second chamber, thereby contaminating the final product. Even if a seal is initially achieved between the

cartridge sidewalls and a fluted, pleated, or corrugated filter, the folded portions are more susceptible to pulling away from the side wall when subjected to hot, pressurized liquid.

b. Artisans would also have been deterred by the threshold problem of manufacturing fluted, pleated, or corrugated filter elements for inclusion in the cartridges. Artisans would not have been interested in incorporating such filters into the Sylvan cartridge design unless the manufacturing process could be fully automated. Under the circumstances, this requires either (1) somehow automatically separating one filter from another after producing a "nest" of filters in bulk or (2) producing the filters individually. Yet the prior art offered no relevant guidance for achieving either one of these tasks.

c. Artisans would further have been deterred by Sylvan's emphasis on a specialized brewing process in which one avoids contact between the filter and the sides of the cartridge. By contrast, then-existing disclosures regarding fluted, pleated, or corrugated filters (e.g., Spiteri) concern filters that are (1) intended for conventional drip brewing equipment and (2) designed to ensure that the filter always stays in good contact with the sides of the brew basket even when using the typical gravity-based brewing process. Combining a reference such as Spiteri with Sylvan's pressurized approach therefore would simply have seemed to guarantee a result (i.e., contact between the filter and the sides of the cartridge) that Sylvan teaches against.

70. Paragraphs 72-111 below provide more detailed explanations for these reasons why artisans as of 2003 would have avoided using a fluted, pleated, or corrugated filter with Sylvan's cartridge design. Each of the three reasons is independently sufficient for me to conclude that '925 claims 1-9, 12-19, and 22-44 would not have been obvious at the time of their invention. Yet it is also important to step back and consider the picture as a whole. Given the

multiple manufacturing-related concerns (i.e., both the difficulty of ensuring an adequate seal and the challenges of forming fluted filters in the first place), an artisan would not have combined Sylvan with Spiteri or some other reference describing a fluted, pleated, or corrugated filter absent some particularly compelling basis to believe that the combination would be desirable once made. In reality, however, the conflicting disclosures in Sylvan and Spiteri offer a separate reason to believe that the combination would be undesirable.

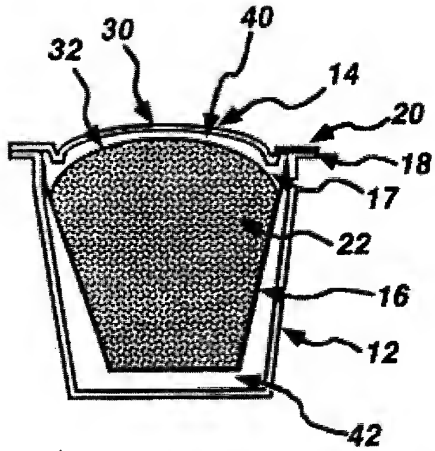
71. Along the same lines, I conclude that the USPTO made multiple errors when concluding that it would have been obvious to combine Sylvan with Spiteri. I document those errors in paragraphs 112-130 below.

A. Reasons Why Artisans Would Have Avoided Using a Fluted, Pleated, or Corrugated Filter With the Sylvan Cartridge

1. Difficulty Achieving the Seal Required by Sylvan

72. Concerns about the difficulty of adequately sealing a fluted, pleated, or corrugated filter to the sidewalls of Sylvan's cartridge would have discouraged people of ordinary skill in the art from even attempting to combine Sylvan with Spiteri or any other reference describing a fluted, pleated, or corrugated filter.

73. As described above, Sylvan discloses a cartridge with a base and a "filter element…sealingly engaged with the opening of the base," with the filter element "divid[ing] the base into two sealed chambers." (Col. 2, lines 10-16). Sylvan teaches that the filter may be made of a synthetic material that can be "easily sealed to the base using heat, ultrasonic energy or microwave energy. (Col. 3, lines 6-10). The seal is critical to Sylvan's brewing process because it separates the coffee grounds from the final product: "The seal formed between filter 16 and base 12 creates two chambers, chamber 40 in which coffee 22 is stored, and chamber 42 which receives the outflow from filter 16." (Col. 3, line 66 to Col. 4, line 1).



Maintaining the integrity of the seal, therefore, is crucial to prevent the brewed beverage in chamber 42 from being contaminated with coffee grounds 22 in chamber 40 that could bypass the filter if the seal were compromised.

74. Yet Sylvan's pressurized brewing environment makes it particularly challenging to maintain such integrity. This is true even when both the cartridge walls and the filter element are perfectly smooth, as illustrated in Sylvan itself. Such difficulties were documented in the Sweeney (U.S. Pat. No. 6,645,537) and Lazaris (U.S. Patent No. 6,589,577) art discussed in paragraphs 35-37 above. Sweeney refers specifically to the Sylvan patent and explains that Sylvan's cartridge had encountered problems "in reliably sealing the rim of the filter component to the interior side wall of the container." (Sweeney Col. 1, lines 47-49).[6] Lazaris likewise emphasized the need for "close tolerances" and the reality that even minor deviations risked the filter "rupture[ing] or becom[ing] dislodged from the container wall during the brewing cycle,

[6] While the Sweeney '537 patent itself had not yet issued as of the September 10, 2003 filing date of the '925 application, the content was publicly available as a result of the published application (No. 2002/0020659) (K103506-515).

resulting in contamination of the brewed beverage with the beverage medium residue from the first chamber." (Lazaris Col. 1, lines 38-43).

75. It was also well known that forming an adequate seal between two surfaces is even more difficult when one (or both) of them is uneven. For example, artisans knew that permanently affixing multiple layers of folded material to a surface is far more challenging than welding a single-layered material of uniform thickness. Parameters (e.g., the degree of heat and the amount of time that it is applied) suitable for sealing a single layer of filter paper to a cartridge are unlikely to be sufficient for sealing three layers bunched together. Yet increasing the temperature and/or the amount of time that the heat is applied so as to provide an adequate seal for the three-layer sections can easily scorch those sections consisting only of a single layer.

76. The Sweeney patent refers directly to such difficulties. Sweeney sought to improve upon the earlier Sylvan design by incorporating flutes into the side wall of the cartridge itself, thereby providing additional strength and reducing the risk of the cartridge itself buckling. This can be seen in Figures 3, 7, and 8 below.

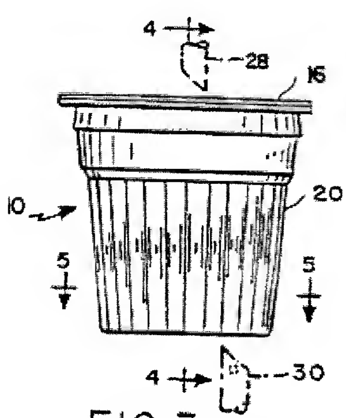


FIG. 3

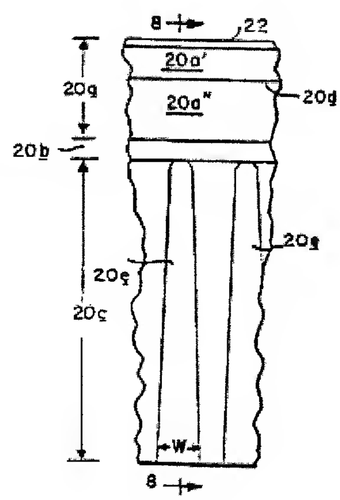


FIG. 7

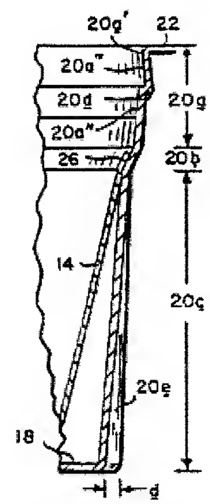


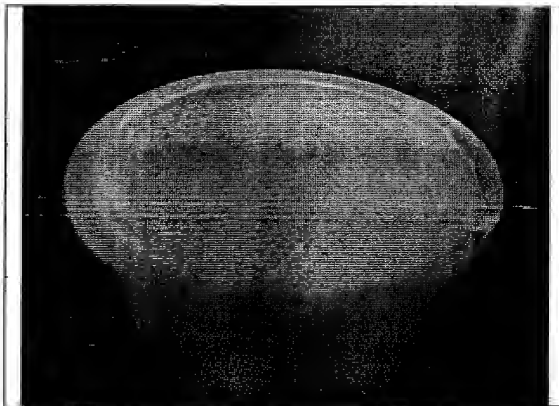
FIG. 8

Recognizing the importance of smooth surfaces for sealing the filter to the container, however, Sweeney emphasized that the upper end of flute 20e should terminate below ledge 20b in Figure 7, "thereby insuring that the ledge[is] not interrupted by discontinuities that would be detrimental to the critical seal of the filter elements to the container side walls." (Col. 5, lines 31-34).[7]

77. Artisans would have understood that comparable "discontinuities" pose problems when trying to seal a fluted filter to a flat side wall. Furthermore, Sweeney's proposed solution – terminating the flutes of the cartridge side walls below the point where the filter is sealed – would be impractical when the filter itself is the fluted element. Techniques such as injection molding make it possible to manufacture even complicated plastic forms to exact specifications for minimal unit cost. By contrast, it is virtually impossible to fold a filter element in a way that provides flutes along the lower portion while leaving a smooth surface at the top for the seal.[8] One must instead select one or the other: a smooth filter or a fluted filter:

[7] Similarly, Lazaris suggested the use of a "planar filter element" (Col. 2, line 6) as well as container ledges that provided "relatively wide and readily accessible surfaces onto which" the edges of the filter could be sealed (Col. 3, lines 60-63).

[redacted] with more than 30 years of experience designing and maintaining fluted-filter-forming machines for various applications (see paragraphs 97-102 below), confirmed this during my discussions with him.



Conical filter with smooth surface

Fluted filter with uneven surface

78. Accordingly, people of ordinary skill in the art would have had compelling reasons not to modify the cartridges illustrated in Sylvan by replacing the smooth filter with a fluted, pleated, or corrugated one (e.g., as shown in Spiteri). Doing so would create an uneven, discontinuous surface, thereby further complicating a problem that Sweeney acknowledged to have been a challenge even with the filter illustrated in Sylvan itself. A filter with any sort of flutes, pleats, or corrugations (as required in all of the '925 application claims) is very difficult to seal to another structure. This is particularly true in the context of Sylvan's disclosure. For any sort of sealing step to be practical, the entire circumference of Sylvan's sidewalls must receive the exact same treatment (e.g., a single amount of "heat, ultrasonic energy or microwave energy" (Col. 3, lines 9-10) for a single amount of time). Yet substituting a fluted, pleated, or corrugated filter in place of the smooth one illustrated in Sylvan necessarily requires sealing both (1) a single layer of filter material to certain portions of Sylvan's sidewall and (2) two or three layers of filter material to other portions of the sidewall. This makes it particularly difficult to form an adequate seal around the entire circumference without burning through any sections thereof.

79. Instead, artisans interested in improving Sylvan's seal would have moved in the opposite direction: toward Lazaris's teaching of a simple planar filter attached to a smooth ledge.

80. Furthermore, it is not enough simply to construct a cartridge in which the filter *appears* to be adequately sealed to the sidewalls. Artisans would also have needed to consider whether the seal was likely to maintain its integrity when subjected to the pressurized brewing environment that Sylvan teaches. In fact, Sylvan's pressurized system would have given artisans particularly strong reasons to avoid using fluted, pleated, or corrugated filters, which inevitably create the sort of disruptions and discontinuities that Sweeney warned against. Even minor imperfections in the seal can quickly turn into complete failures as a result of pressurized water following the path of least resistance and thus flowing into the lower chamber (and ultimately the user's cup) without passing through the filter. Such water would dilute the brewed beverage. The breach could also lead to coffee grounds falling into the lower chamber as well, thereby contaminating the final product.[9] Even small quantities of particles can lead to unacceptable results

81. Prior art references such as Spiteri and Michielsen (to say nothing of common sense[10]) emphasize the need to <u>prevent</u> such dilution and contamination.

82. For example, Spiteri discloses a filter designed "to prevent the contamination and unwanted weakening of the infusion with unfiltered product that has bypassed the filter." (Para. 1). Spiteri's flutes may facilitate these goals in the context of conventional drip brewing, as the flutes reduce the likelihood that the filter will collapse when sitting in the brew basket. With Sylvan's brewing system, however, artisans would have worried about the flutes and resultant discontinuities further complicating the already-challenging process of ensuring that the

[9] Even small quantities of particles can lead to unacceptable results.

[10] For example, Keurig agreements define "filter weld failure" as occurring when as little as three grains of coffee appear in the brewed beverage. (E.g., License and Distribution Agreement between Keurig, Incorporated and Tully's Coffee Corporation (K000463-523) ¶ 5.3).

filter is "sealingly engaged" (Col. 2, lines 12) with the sides of the cartridge. Yet this seal – never even suggested in Spiteri, which concerns an entirely different kind of brewing – is precisely why dilution and contamination are <u>not</u> concerns when Sylvan's cartridge functions properly. Incorporating a fluted, pleated, or corrugated filter would have seemed like going in exactly the wrong direction.

83. Michielsen likewise teaches the importance of maintaining a seal between a filter and side wall to avoid liquid bypassing the filter. As described above, the Michielsen filter consists of an envelope that contains ground coffee and fits snugly within the bottom of a circular vessel. Water poured into the vessel "ensures a systematic sealing" between the envelope and the inner walls of the vessel so that "all the boiling water is necessarily expelled and forced to pass through aforesaid envelope." (Col. 3, lines 34-38).

84. In short, the disclosures in Spiteri and Michielsen teach strongly <u>away</u> from incorporating flutes, pleats, or corrugations into the Sylvan invention. This is particularly clear in light of Sweeney, which emphasizes the danger of "discontinuities" and describes the challenges of obtaining an adequate seal even with the ordinary smooth filter that Sylvan itself illustrates.

85. Yet every single one of the pending claims in the '925 application requires a cartridge having a filter that incorporates flutes, pleats, or corrugations and is also "directly joined" to the interior of the cartridge. This itself leads me to conclude that the '925 claims would not have been obvious.

86. In fact, I understand that Keurig experienced significant problems in practice when trying to develop manufacturing processes to seal fluted filters to the cartridge sidewalls. It was even necessary to retrieve the initial production line from Green Mountain Coffee

Roasters and return it to Keurig for further development. (Discussions with Mr. Kevin Sullivan, Keurig's Vice President of Engineering).

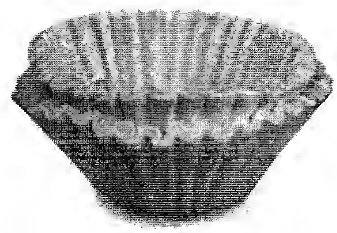
2. <u>Difficulty Manufacturing Fluted Filters Themselves</u>

87. Sealing-related concerns are hardly the only reason why people of ordinary skill in the art as of 2003 would have avoided using a fluted, pleated, or corrugated filter in Sylvan's cartridge design. Artisans would also have been discouraged by the challenge of manufacturing the necessary filters in the first place (i.e., before sealing them to the cartridge sidewalls). Without some concrete basis to believe that such a manufacturing process could be practical, there would not have been any reason for artisans to test the combination even on a small scale. In fact, there are multiple reasons why the manufacturing challenges would have seemed particularly difficult to overcome.

88. For one, people of ordinary skill in the art would have recognized the need for a manufacturing process that produced filters almost perfectly symmetrical. Variations of even a few hundredths of an inch would result in unacceptable sealing, as certain portions of the circumference of the filter would be welded too "high" or "low" relative to the "lip or rim" described in Sylvan (Col. 3, line 4).[11]

89. Artisans would also have recognized the need for the production line to turn out individual filters, as opposed to the typical "nest" that one encounters when buying fluted filters for conventional drip brewers:

[11] This is somewhat less of a concern with many of the filter designs illustrated in Sylvan itself, as the tip of the cone may be attached to the bottom of the cartridge as an additional point of reference.



The reason itself is simple: one ultimately must attach a single filter – not an entire nest – to the cartridge.

90. In order to turn out individual filters on a production line, however, one would have needed either (1) to devise a suitable means for automated "de-nesting" or (2) to form filters using only a single layer of filter paper (as opposed to multiple sheets, which would afford the "nest" of filters).

91. In the context of the Sylvan cartridge design, neither one of these options would have been at all appealing to a person of ordinary skill as of 2003.

92. One reason is Sylvan's emphasis on using filter paper that was lightweight and heat-sealable, such as paper incorporating plastic fibers (e.g., Col. 2, lines 37-39). This teaches away from the idea of forming multiple fluted filters at a time and then de-nesting them.

93. For one, artisans would have recognized that the manufacturing process itself was likely to generate significant amounts of heat. When using stacks of the heat-sealable filter paper as taught in Sylvan, however, such heat would cause the fluted filters to fuse together just as the nests themselves were being formed. This would make de-nesting difficult or impossible even manually, let alone with a machine.

94. Yet without incorporating plastic or some other heat-sealable material into the filter paper, however, it would not be practical to fulfill Sylvan's teaching of a "filter element disposed in the base sealingly engaged with the opening of the base" (Col. 2, lines 11-12).

95. Furthermore, the vacuum-based processes known in the prior art for automatically de-nesting (e.g., U.S. Patent No. 6,623,236) would not have worked well in connection with lightweight filter paper (as opposed to the heavier waxed paper that had been used to form conventional fluted cups for the baking and confectionary industries). Yet there were not any other practical solutions for automatic de-nesting.

96. Nor would forming one filter at a time have been any more appealing a challenge to solve. Working with a single sheet of filter paper creates various problems in its own right, as one loses the helpful insulating effect of having many sheets together to cushion the impact of the colliding dies. This would have been a particular concern in light of the above-discussed need for tremendous precision in the dimensions of the finished fluted filter.

97. My conclusions are confirmed by discussions that I have had with REDACTED [redacted]. REDACTED is a skilled machinist with over 30 years of experience building and maintaining machines for forming fluted filters and other fluted cups, including numerous different designs sought by customers in the coffee, baking, and confectionary industries. I understand that REDACTED was approached by Keurig in 2003 or 2004 (i.e., after the invention described in the '925 application) to develop equipment for forming fluted filters to go in Keurig K-Cup portion packs. As of that time, REDACTED was not familiar with any previous work on automated de-nesting mechanisms for coffee filters.[12] Nor was REDACTED familiar with

[12] While he was aware of automatic de-nesting mechanisms for use with <u>waxed</u> papers (e.g., for use by bakeries), this is not the sort of material that Sylvan describes.

workable methods for forming fluted cups one at a time (i.e., using a single sheet of paper) except when simply testing dies. Instead, in all of his long experience, entire nests of fluted filters were sold together (as in the picture above), and it was left to the end user to separate the individual filters by hand prior to placing them in the brew basket. This is a reasonable solution for conventional drip brewing in the kitchen or coffee shop, but completely impractical if one moves to the factory floor and seeks to produce large quantities of beverage filter cartridges for use in a Sylvan-type system.

98. Indeed, I understand that REDACTED and his company [redacted]) were never able to achieve an automated de-nesting mechanism for use with filter paper. They instead turned to the problem of forming filters one sheet at a time.

99. I also understand that REDACTED and others at REDACTED had considerable difficulty developing suitable equipment for producing acceptable fluted filters one at a time. These difficulties were consistent with the results that machinists such as REDACTED and his predecessor REDACTED had observed in the past when running tests using a single sheet of paper to assess how dies were cutting. Without a thick stack of sheets to absorb the impact, the tremendous force unleashed by the colliding dies created a host of problems.

100. For example, the cutting surfaces quickly would grow dull and begin turning out filters that were somewhat off-center. As previously explained, however, even small variances undermine the integrity of the seal between the filter and the cartridge sidewalls.

101. The punch also tended to rotate somewhat within the female die, thereby pinching the filter and causing the paper to tear. Yet even minor tears can make it impossible to achieve an adequate seal.

[redacted]

102. Solving these problems proved very difficult for REDACTED and REDACTED. REDACTED [redacted] went so far as to lease back a machine built for another REDACTED customer and in turn use it as a test platform for three months. REDACTED and his team ultimately had to equip their dies with specialized shock absorbers, which never beforc had been used with fluted-cup forming machinery. They also had to eliminate virtually all variances and imperfections in the die grooves. Even an aerospace machine shop using high-end milling equipment was unable to achieve the necessary precision. It instead proved necessary to file the grooves by hand.

103. The prospect of difficulties such as these would have been a concern for every single one of the '925 application's pending claims, all of which require filters that incorporate flutes, pleats, or corrugations. The challenges of individually forming fluted filters is thus another reason why I conclude that none of the '925 claims would have been obvious to a person of ordinary skill in the art as of 2003.

104. In summary, manufacturing-related concerns would have deterred people of ordinary skill in the art from creating filter cartridges in which the filter element (1) has pleats, flute, or corrugations and (2) is "directly joined at a peripheral junction to an interior" of the cartridge's side wall, as required in all of the pending '925 claims. If one desired to join the filter to the side wall, the necessary specifications of the filter element (e.g., lightweight, heat-sealable paper) would have deterred artisans from making the filters in nests. Yet moving to single-sheet production would not have been any more appealing to artisans, as such a step would have rendered obsolete the entire knowledge base as to then-existing techniques for forming fluted filters. These twin problems would have given people of ordinary skill in the art ample reason to explore other paths (e.g., variations on the cartridges disclosed in Lazaris, using a simple planar filter element) and avoid fluted filter designs entirely.

3. **Sylvan's Emphasis on Avoiding Contact Between the Filter and the Cartridge Sidewall**

105. Sylvan's emphasis on keeping the filter element from collapsing against the cartridge walls even during the beverage brewing process (e.g., Col. 1, lines 50-53 & Col. 3, lines 10-26) is yet another reason why it would not have been obvious to replace the filters actually illustrated in Sylvan with a fluted, pleated, or corrugated design.

106. Sylvan's smooth conical filter would normally be quite effective in resisting deformation even when subjected to the pressurized hot water that Sylvan envisions (e.g., Col. 4, lines 23-24). When the top edges of such a filter are "sealingly engaged" with the sidewall (Col. 2, lines 11-12), it is all but impossible for the filter as a whole to expand substantially outward and thereby come into contact with the container sidewalls.

107. By contrast, artisans would have worried about fluted, pleated, or corrugated filter elements collapsing against the sidewalls when subjected to the pressurized hot water. Such flutes, pleats, and corrugations are necessarily more conformable.

108. In fact, that greater conformability is exactly why references such as Spiteri, Frise, and Michielsen recommend flutes, pleats, or corrugates for use in conventional brewing systems in which users desire to <u>ensure</u> contact between the filter and the brew basket (e.g., so as to avoid dilution or contamination of the brewed beverage). For example:

- Spiteri, claim 1 (describing a filter with at least "four longitudinal folds" that act as "supporting members" and ensure that the filter is able "to conform and adapt" to the walls of the brew basket) and Figure 5 (depicting the filter element in contact with the brew basket);
- Frise, pages 3-4 (explaining how the flutes allow the filter to mould itself to the full shape of various different brew baskets); and
- Michielsen, Col. 1 (recommending the use of "pleated walls" so as to ensure "a firm connection").

109. Such knowledge regarding the tendency of fluted, pleated, and corrugated elements would have dissuaded people of ordinary skill in the art as of 2003 from using a fluted, pleated, or corrugated filter in Sylvan's cartridge.

110. Indeed, there was no reason at all for artisans to believe that flutes, pleats, or corrugations could help prevent the filter from contacting other structures in conventional gravity-based brewing, let alone Sylvan's specialized pressurized process.[14] Yet preventing such contact is exactly what Sylvan emphasizes.

111. Thus, Sylvan and the fluted filter references point in opposite directions. People of ordinary skill would have believed them to be incompatible – two unrelated solutions for two very different brewing mechanisms.

B. Specific Flaws in the USPTO's Analysis

112. For similar reasons, I conclude that there are an array of fundamental defects in the theories offered by the USPTO as to why people of ordinary skill in the art purportedly would have combined Sylvan with Spiteri (and in certain cases with additional references such as Daswick or Michielsen). Those alleged reasons shifted over the course of prosecution, but collectively included the following:

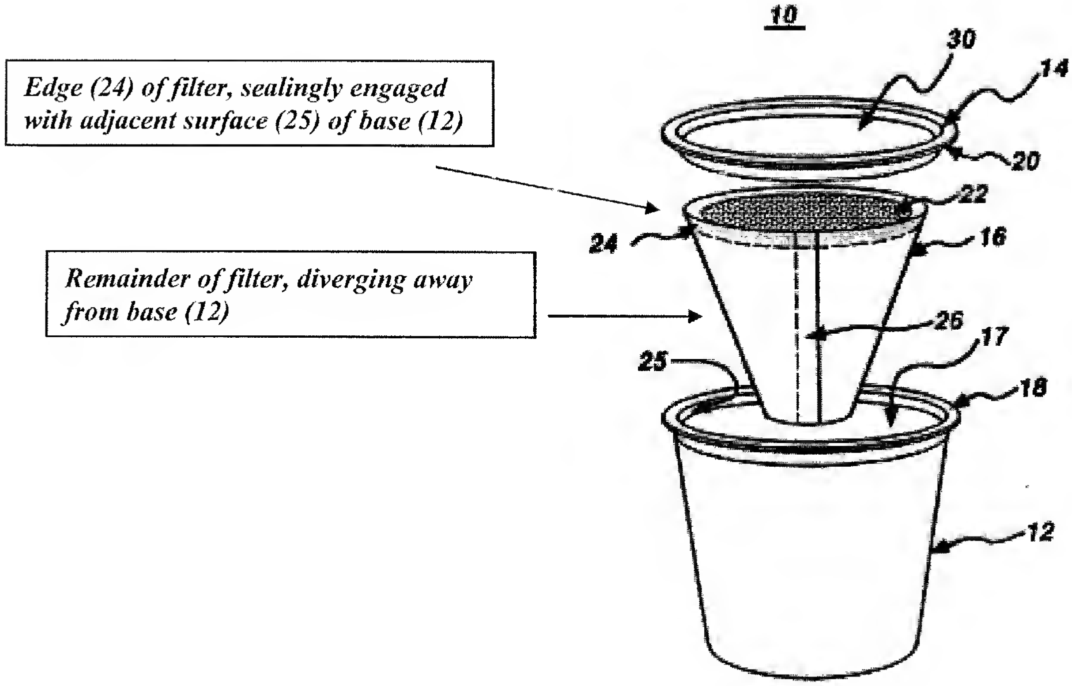
- to "further augment the self-supporting aspect" of Sylvan's filter;
- to avoid collapse or sagging when Sylvan's filter is wetted;
- to increase the effective filtering area,
- to achieve a higher liquid flow rate; and
- to facilitate handling and packaging as well as cost-effective production.

[14] It is particularly telling that the prior art as of 2003 appears to lack any disclosure whatsoever of using fluted, pleated, or corrugated filters with pressure-based brewing methods.

(Office Actions mailed on August 10, 2007 and January 20, 2008; Examiner's Answer to Applicants' Revised Appeal Brief; Board of Patent Appeals and Interferences Decision on Appeal, decided July 24, 2009; Board of Patent Appeals and Interferences Decision on Request for Rehearing, decided October 14, 2009).

1. "Further augment the self-supporting aspect" of Sylvan's filter

113. The USPTO focused on the idea of a "self-supporting" filter while ignoring the reality that Sylvan and Spiteri coincidentally use this same term to refer to two entirely different and mutually-exclusive concepts. Sylvan uses the term to emphasize the need for a filter that does not collapse against the sidewalls of Sylvan's cartridge even when subjected to pressurized hot water. (E.g., Col.1, lines 50-54 & Col. 3, lines 11-13). Sylvan achieves this goal by (1) selecting appropriate filter material and (2) sealing the top edges of the filter to the cartridge itself while ensuring that the filter otherwise has a different shape so as to diverge from the base. (Col. 2, lines 10-15):



114. Spiteri happens to uses the same word (i.e., "self-supporting") to describe an entirely different concept: using flutes or pleats to prevent the filter from collapsing in a way that allows water or beverage media (e.g., coffee grounds) to bypass the filter entirely and pass directly into the finished beverage. (paras. 1-3). This is typically a problem when the filter collapses in on itself and <u>away</u> from the sides of the brew basket, thereby opening a path for the water or coffee grounds. <u>See</u> Ted R. Lingle, <u>The Coffee Brewing Handbook</u> (Specialty Coffee Association of America, 1996) p. 44 (noting that paper filters can "fall <u>***away***</u> from the sides of the brew basket and possibly cause the water to bypass the coffee bed") (emphasis added); <u>cf.</u> Michielsen U.S. Patent No. 3,389,650, Col. 3, lines 36-38 (teaching steps to ensure "a systematic <u>***sealing***</u> on account of which all the boiling water is necessarily expelled and forced to pass through aforesaid envelope 17") (emphasis added).

115. By sealing the filter to the base and thereby ensuring that the pressurized hot water must pass through the filter and associated bed of coffee or other beverage medium, Sylvan had already addressed the problem that Spiteri was trying to solve for the very different environment of "conventional" coffee brewing (Abstract; Para. 21). With Sylvan's pressurized system, the only lingering concern (as documented in Sweeney) was the durability of the seal itself. As discussed above, this itself was a reason not to switch from a smooth filter to a fluted, pleated, or corrugated one.

2. to avoid collapse or sagging when Sylvan's filter is wetted

116. The USPTO also wrongly concluded that artisans would have incorporated flutes, pleats, or corrugations into Sylvan's filter so as to "avoid collapse or sagging." As discussed above, the smooth conical filters that Sylvan discloses are highly resistant to sagging. Incorporating flutes, pleats, or corrugations would have gone in the wrong direction by increasing the amount of filter surface area exposed to the pressurized fluid required for Sylvan's brewing method. This would promote collapse or sagging – not deter it.

3. **to increase the effective filtering area**

117. Further, I disagree with the USPTO's finding that artisans would have combined Spiteri with Sylvan so as to increase Sylvan's effective filtering area. There is nothing in Sylvan or any other prior art to suggest a reason why people of ordinary skill would have sought a larger effective filtering area than that achievable by making the particular cartridges illustrated in Sylvan itself (e.g., SLOCUM0035 – the "conical filter" cartridge that I used in my experiments).

118. In fact, the USPTO's rationale runs counter to Sylvan's teaching that it was a central "object of [the] invention" to provide a beverage filter cartridge that "requires only a small filter element." (Col. 1, lines 54-56). In other words, Sylvan envisioned increasing the

effective area of the filter without adding to the total area that had to be exposed to the pressurized water. Sylvan achieved this goal by keeping the working area of the filter away from the walls of the cartridge, which could interfere with the free flow of water through the filter. (Col. 3, lines 22-26). Once again, artisans interested in Sylvan's technology would have brushed aside Spiteri's fluted, pleated, and/or corrugated filter design as leading in exactly the wrong direction. Combining Spiteri with Sylvan would have increased the likelihood of at least portions of the filter conforming to the cartridge walls (e.g., as recited in Spiteri claim 1 and illustrated in Figure 5) and thereby decreasing the effective filter area – exactly the problem that Sylvan's own design successfully avoided.[15] As the USPTO itself acknowledges, however, using a fluted, pleated, or corrugated filter as disclosed in Spiteri "requires adding an additional amount of the filter material." (BPAI Decision on Appeal at pp. 12-13). In other words, combining Spiteri with Sylvan would have increased the total area of the filter element, thereby once again contradicting Sylvan's own teaching.[16]

4. **to achieve a higher liquid flow rate;**

119. The USPTO also incorrectly concluded that people of ordinary skill in the art would have combined Sylvan and Spiteri for purposes of achieving a higher liquid flow rate. Nothing in the prior art suggested a reason why artisans would have desired a faster flow rate

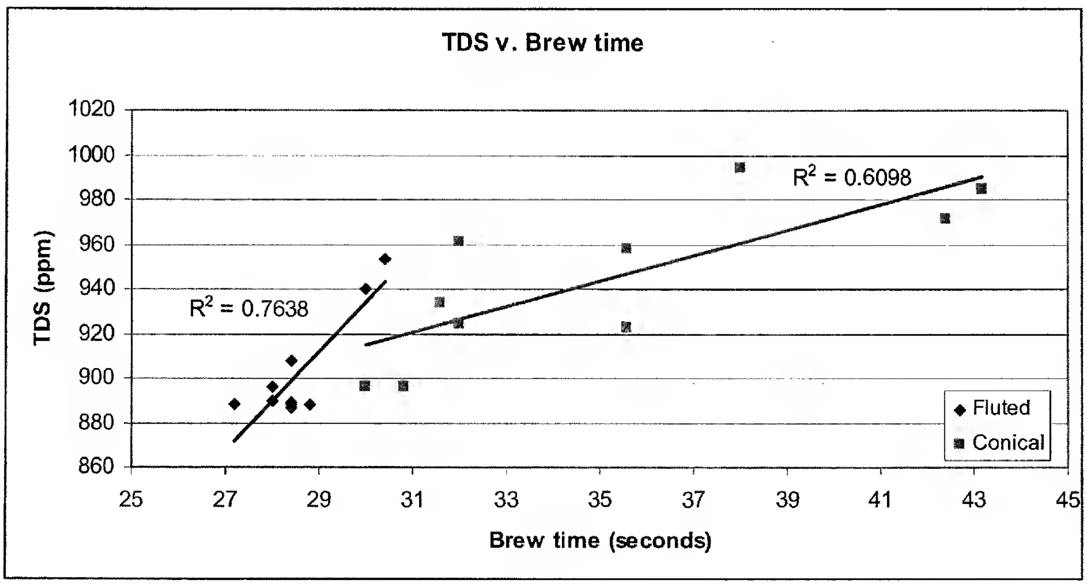
[15] In my own experiments using the cartridges with the translucent side walls, I observed contact between the filter and the sidewalls when testing cartridges with fluted-filter elements (i.e., SLOCUM0037 and SLOCUM0039). I did not observe any such contact when testing cartridges with smooth conical-filter elements (i.e., SLOCUM0038).

[16] While Spiteri suggests that the pleats and folds require "only a small amount of additional material" (Para. 11), the fact remains that such a change would run counter to Sylvan's own emphasis. Furthermore, even if one wrongly ignored Sylvan's teaching and assumed (incorrectly) that artisans would have desired a larger filter area, Spiteri itself would have been unappealing for this purpose. Given the known difficulties of sealing discontinuous surfaces (see paragraphs 75-77 above), artisans would have had no interest in combining Sylvan and Spiteri simply for the purpose of obtaining a "small amount" of additional surface area.

than that obtainable by using a cartridge exactly along the lines illustrated in Sylvan itself (e.g., SLOCUM0038 – the "conical filter" cartridge that I used in my experiments). If anything, market pressures would have <u>deterred</u> people from seeking a higher flow rate.

120. Specifically, I understand from discussions with Mr. Ted Lingle that artisans in the coffee industry have long understood that reducing the amount of time that water is in contact with the coffee grounds (i.e., "dwell time") reduces the TDS level of the brewed product, leading to a weaker cup of coffee. My own experiments confirmed this.

121. The following graph charts the results of my second set of experiments and compares TDS against brew time:



122. In short, TDS readings were directly correlated with brew time for both conical filters (as illustrated in Sylvan itself) and fluted filters. While there was some overlap of brew times between the two filter types, on average the fluted filter brewed slightly faster. As expected, the fluted filter's shorter brew times consistently produced lower TDS values.

123. At the time that Keurig was selling cartridges with filters as illustrated in Sylvan, however, I understand that customers complained that the resultant coffee was too weak. (E.g., Keurig Update, May 7, 2004 (K000213-227) at K000214; Board of Directors Update 12/10/03 At Home Division (K075483-88) at K075485). Indeed, this is corroborated by the '925 application's own discussion of the desire to <u>increase</u> TDS values. (K000619).

124. Thus, artisans would have wanted to <u>avoid</u> increasing the flow rate beyond what one could achieve using the designs illustrated in Sylvan.

5. to facilitate handling and packaging as well as cost-effective production

125. Finally, I am not aware of any reason why artisans would have believed that using a fluted, pleated, or corrugated filter as disclosed in Spiteri in place of the smooth conical filter illustrated in Sylvan would have facilitated handling, packaging, and/or cost-effective production of Sylvan's cartridges. The patent examiner did not offer any explanation along these lines. Nor did the Board of Patent Appeals and Interferences even mention the issue.

126. In fact, paragraphs 72-104 above explain why reliability and manufacturing-related concerns (e.g., ensuring an adequate seal between the filter and the cartridge sidewall) would have <u>deterred</u> artisans from combining Sylvan with a fluted, pleated, or corrugated filter. Artisans desiring to simplify manufacturing would instead have moved in the direction of the simple planar filter disclosed in Lazaris.

127. While Spiteri's filter ostensibly can be packaged in a "flat configuration" (Para. 7), nothing in Spiteri suggests how to design a workable manufacturing process for actually producing fluted filters in such an arrangement.

128. Even if a person of ordinary skill as of 2003 could have developed such a manufacturing process for producing stacks of folded fluted filters, this is the last thing that one would have wanted to do in the context of Sylvan's disclosure.

129. In order to produce beverage filter cartridges, one must insert the filter into the cartridge in an unfolded state. This allows for the addition of the coffee or other beverage medium (i.e., into the upper chamber defined by the unfolded filter itself) and the subsequent sealing of the cartridge, thereby rendering it ready for use.

130. Furthermore, it would be needlessly complicated and expensive to form a stack of folded filter elements and then later unfold them for insertion into cartridge bases. Efficient production instead requires that the filters be inserted into cartridges as quickly as possible after being formed, as part of an integrated manufacturing line. Once again, Spiteri describes a concept relevant to "conventional" coffee brewing systems (e.g., automatic drip machines), but completely irrelevant and/or counterproductive with respect to the specialized system described in Sylvan.

I declare under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge and belief.

Executed on July 8, 2011

Alexander H. Slocum

EXHIBIT A

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

School of Engineering Faculty Personnel Record

Date July 8, 2011	Full Name:	Alexander H. Slocum
	Department:	Mechanical Engineering

1. Date of Birth: on file

2. Citizenship: U.S.

3.

School	Degree	Date
M.I.T.	S.B., M.E	June 1982
M.I.T.	S.M., M.E	Jan. 1983
M.I.T.	Ph.D., M.E.	June 1985

4. Title of Thesis for Most Advanced Degree:

   Sensor System Design to Determine Position and Orientation of Articulated Structures

5. Principle Field of Interest:

   Precision Engineering

6. Name and Rank of Other Department Faculty in the Same Field:

   David Trumper, Professor
   Martin Culpepper, Associate Professor
   Sangbae Kim, Assistant Professor

7. Name and Rank of Faculty in Other Departments in Same Field:

   Jeff Lang, Professor, Electrical Engineering

8. Non-MIT Experience:

Employer	Position	Beginning	End
NIST	Mechanical Engineer	June 1982	Sept. 1986
Cranfield Inst. Tech.	Visiting Professor	Oct. 1989	Oct. 1990

9. History of M.I.T. Appointments:

Rank:	Beginning	End
Assistant Professor (CE)	Sept. 1985	July 1989
Assistant Professor (ME)	July 1991	July 1992
Associate Professor (ME)	July 1992	July 1995
Associate Professor (ME, tenured)	July 1995	July 1998
Professor	July 1998	?

10. Consulting Record: (3 dozen+ companies, names available upon request)

11. Department and Institute Committees, Other Assigned Duties:

Activity	Beginning	End
Inst. Comm. on Design in UG Education	Feb. 1987	June 1988
Inst. UG Admissions Folder Reader	Jan. 1987	Present
Inst. Committee on the Hobby Shop	July 1989	June 1997
Chairman, Inst. Committee -- Hobby Shop	June 1997	Present
Dept. Committee on Graduate Curricula	Oct. 1992	June 2004
Dept. Support Staff Cost Committee	Mar. 1994	May 1994
Pi Tau Sigma Faculty Advisor	May 1994	Jan. 2002
Dept. Faculty Search Committee	Jan. 1995	June 1995
Leader, OME 2nd Summer Design Program	Jan. 1996	Jan. 2008
MIT Educational Council	June 1996	Present
ME Strategic Planning Committee	Sept. 1996	June 1998
ME Design Faculty Search Committee	Jan. 1997	June 1998
Designated Course Professors Committee	Sept. 1997	June 2004
ME Design Faculty Search Committee	Jan. 1998	Nov. 1998
Space Committee	Jan. 2000	Sept. 2003
CalTech/MIT Voting Commission	Jan. 2001	June 2001
ME Council	Jan 2004	June 2005
Director: Experimental Study Group	Sept. 2004	Present
Research Administration Improvement Initiative	July. 2005	Present
co-chair of the Class of 1982 Reunion Gift Fund	Spring 2007	
Energy Education Task Force	Dec. 2008	Present
Institute Committee on Student Life	Aug. 2009	Present
Energy Minor Oversight Committee	Feb. 2009	Present
Daper Advisory Board	Aug. 2009	Present
Institute Committee on Student Life, Chair	June 2010	Present

12. Professional Service:

Activity	Dates
Office of Secretary of Defense, Foreign Strategic Trade	June 1990-June 2005
Department of Justice, Bearing Tariffs Jan.1992-Dec.1992	
NIST, Technology Assessment	June 1986-Aug. 1997
Amer. Soc. Precision Eng., Nominations May 1997-present	
National Science Foundation, Review panel	June 1991-present
International Scientific Committee of the European Union Society for Precision Engineering and Nanotechnology	Feb. 2004-present
Session Chair "Education" 4th. Intl. Conf. Advanced Engineering	

Design, Glasgow, Scotland,	Sept. 5-8, 2004
Vice Chair, ASME Design Education Committee	2005
Session Chair ASME IDETC "Creativity in Design", Las Vegas NV	Sept., 2007
Town of Bow Energy Conservation Committee	Dec, 2007-20012
Session Chair ASME IDETC "Creativity in Design", NY, NY	Sept., 2008
Department of Energy: BP Gulf Oil Spill response team	May 2010-Sept. 2010

13. Awards or Honors Received:

1.	U.S. DoC Development of an Advanced Robot Gripper	Feb. 1984
2.	U.S. DoC Outstanding Performance Rating	Mar. 1985
3.	SME Outstanding Contribution to FMS	Feb. 1986
4.	U.S. DoC Outstanding Performance Rating	Mar. 1986
5.	U.S. DoC Outstanding Performance Rating	Mar. 1986
6.	U.S. DoC Development of Robotic Micromanipulator	June 1986
7.	U.S. DoC Robot End Effector Patent	July 1986
8.	U.S. DoC Robotic Micromanipulator Patent	July 1986
9.	SME Outstanding Contribution to Robotics	Aug.1986
10.	U.S. DoC Bronze Medal Award for Federal Service	Dec. 1986
11.	NSF Presidential Young Investigator	June 1987
12.	Royal Society Visiting Scholar Fellowship	Aug. 1988
13.	Oak Ridge Offsite Research Fellowship	Aug. 1988
14.	SME Earl E. Walker Outstanding Young Manufacturing Engineer Award	June 1993

15. ASCE 1994 Thomas Fitch Rowland Prize
16. 1994 R&D 100 Award for one of 100 best new technical products of the year (ShearDamper™)
17. 1994 International Machine Tool Show "Best of Show" award for development of Weldon Machine Tool's 1632 Gold Cylindrical Grinder (it used Slocum's hydrostatic bearings and ShearDamper technology).
18. 1994 R&D 100 Award for one of 100 best new technical products of the year (HydroGuide™)
19. 1995 R&D 100 Award for one of 100 best new technical products of the year (HydroSpindle™)
20. 1996 R&D 100 Award for one of 100 best new technical products of the year (TurboTool™ Ultra-High Speed Spindle)
21. SME 1997 SME Frederick W. Taylor Research Medal
22. 1997 R&D 100 Award -one of 100 best new technical products of the yr. (Machining Variation Analysis)
23. 1997 R&D 100 Award-- one of 100 best new technical products of the yr. (ShieldBeam™ Contactor)
24. 1997 R&D 100 Award-- one of 100 best new technical products of the yr. (Kinematic Docking System)
25. 1998 R&D 100 Award-- one of 100 best new technical products of the yr. (Q-Tool™)
26. Who's Who in America Science and Engineering
27. Martin Luther King Jr. Leadership Award, January 1999.
28. MacVicar Faculty Fellow, January 1999.
29. 1999 R&D 100 Award-- one of 100 best new technical products of the yr. (Quasi Kinematic Coupling for Engine Assembly)
30. Massachusetts Professor of the Year Award, November 2000
31. ASME Leonardo da Vinci Award, 2004
32. 100K Competición Winner (2007, Team Robopsy)
33. ASME Machine Design Award, 2008
34. 2008 R&D 100 Award.-one of 100 best new technical products of the yr. (Saber Furnace)
35. 2009 R&D 100 Award -one of 100 best new technical products of the yr. (Micro-ESR with Active Spectrum, Inc).

36. 2010 Arthur Smith Faculty Achievment Award

15. Current Organization Membership:

American Society of Mechanical Engineers, Fellow
Society of Manufacturing Engineers, Member
American Society for Precision Engineering, Member
IEEE, Member

16. Patents:

1) Slocum, "Mechanism for Determining Position and Orientation in Space", 4,606,696, August 19, 1986
2) Slocum, "Mechanism for Determining Position and Orientation in Space", 4,676,002, June 30, 1987
3) Slocum, J. Peris, "Method and Mechanism for Fixturing Objects", 4,685,661, August 11, 1987
4) A. Slocum, J. Peris, L. Greenspan, "Robotic Micromanipulator", 4,694,230, September 15, 1987
5) A. Slocum, P. Jurgens," Double End Effector", 4,765,668, June 23, 1988
6) A. Slocum, "Inclined Contact Recirculating Roller Bearing", 4,765,754, June 23, 1988 (NIST).
7) A. Slocum, "Method and Mechanism for Converting Rotary to Linear Motion", 4,836,042, June 6, 1989
8) A. Slocum, "Multiple Actuator Hydraulic System & Rotary Control Valve", 4,838,145, June 13, 1989
9) E. Heatzig, A. Slocum, "Multi-Axis DSP-Based Parallel Processing Servo Controller for Machine Tools and Robots", #4,878,002, October 31, 1989
10) A. Slocum, D. Thurston, "System to Provide High Speed, High Accuracy Motion", #4,987,526, Jan. 22, 1991
11) Z. Saidin, A. Slocum, "Brushless Motor Control Method and Device", #5,023,528, June 11, 1991
12) A. Slocum, A. Ziegler, "Automated Shear Stud Welding System", #5,130,510, July, 1992
13) A. Slocum, "System to Convert Rotary Motion to Linear Motion", #5,090,265, Feb. 25, 1992
14) A. Slocum, "Self Compensating Hydrostatic Linear Bearing", #5,104,237, April 14, 1992
15) A. Slocum, "Self -Compensating Hydrostatic Bearings for Supporting Round Shafts for Rotary and/or Linear Motion", #5,281,032, February 20, 1994
16) A. Slocum, "High Speed Hydrostatic Spindle", #5,466,071, Nov. 1995
17) A. Slocum, J. Olson, "Machine Tool Apparatus and Linear Motion Track Therefore", #5,472,367, Dec. 5, 1995
18) A. Devitt, A. Slocum, "Method for Manufacturing Externally Pressurized Bearing Assemblies", #5,488,771, Feb. 6, 1996
19) A. Slocum, K. Wasson, "Low Profile Self Compensated Hydrostatic Thrust Bearing", #5,533,814, July 1996
20) A.Slocum, "Slit-Tube Replicated In-Place Constrained Layer Damper and Method", #5,667,204, September 1997
21) A. Slocum, D. Braunstein, L. Muller, "Flexural Kinematic Couplings", #5,678, 944, October 1997
22) N. Kane, A. H. Slocum, "Elastically Supported Self-Compensating Flow Restrictors for Optimizing Hydrostatic Bearing Performance", #5,484,208, Jan. 1996
23) A. Slocum, "Method and Apparatus for Locating and Orienting a Part on a Gripper and Transferring it to a Tool while Maintaining Location and Orientation on the Tools", 5,711,647, January 1998
24) A. Slocum, T. Solomon, "Robotic Joint Using Metal Bands", # 5,682,795, December 1997
25) K. L. Wasson & A.H. Slocum, "Integrated Shaft Self-Compensating Hydrostatic Bearing", #5,700,092, Dec. 23 1997

26) A. Slocum, K. Wasson, "Tooling System and Method with Integral Hydrostatic Bearings and Turbine Power Source", #5,674,032, Oct. 7, 1997
27) A. Slocum, "Method and Apparatus for Damping Bending Vibrations While Achieving Temperature Control in Beams and Related Structures", #5,743,326
28) A. Slocum, "Kinematic Coupling Fluid Couplings and Method", #5,683,118
29) A. Slocum, et-al, "Modular System", #5,733,024, March 31, 1998
30) A. Slocum, S. Ziegenhagen, R. Slocum, L. Muller, "Integrated Circuit Tray with Flexural Bearings", #5,758,776, June 2, 1998
31) M. Culpepper, A. Slocum, "Debris cleaner with compound auger and vacuum pickup", 5,784,756 July 28, 1998
32) A. Slocum, M. Chiu, "Interface Apparatus for Automatic Test Equipment", #5,821,764, Oct. 1998
33) A. Slocum, E. Marsh, D. Smith, "Replicated In-Place Internal Viscous Shear Damper for Machine Structures and Components", #5,799.924, Sept. 1, 1998
34) A. Slocum, "Surface Textured Cleansing Device and Method with Massaging Effect", #5,834,410, Nov. 10, 1998
35) A. Slocum, S. Ziegenhagen, "Expanding Gripper with Elastically Variable Pitch Screw", #5,839,769, Nov. 24, 1998
36) A. Slocum, "Kinematic Coupling Method And System For Aligning Sand Mold Cores And The Like And Other Soft Objects And Surfaces", #5,769,554
37) A. Slocum, J. Miskoe, "Container Restraining Mechanism and Method, #5,848,669, Dec. 15, 1998
38) A. Slocum, et. al., "I.S. Machine" (bottle making machine for Emhart Glass), #5,858,050, Jan. 12, 1999
39) A. Slocum, et. al., "Mold Carrier Assembly for an I.S. Machine Mold Opening and Closing Mechanism" (bottle making machine for Emhart Glass), #5,865,868, Feb. 2, 1999.
40) A. Slocum, et. al., "Mold Opening and Closing Mechanism for an IS Machine", #5,887,450, March, 1999
41) A. Slocum, C. Ho, "Modular Storage System, Components, Accessories, And Applications To Structural Systems And Toy Construction Sets And The Like", # 5,888,114, March 30, 1999
42) A. Slocum, D. Braunstein, "Kinematic Coupling for Thin Plates and Sheets and the Like", #5,915,678, June 29, 1999
43) A. Slocum, "Method of Manufacturing Ball Grid Arrays for Improved Testability", #5,924,003, Jul. 13, 1999.
44) A. Slocum, R. Ziegenhagen, "Flexible shielded laminated beam for electrical contacts and the like and method of contact operation", #5,921,786, July 1999
45) A. Slocum, et. al., "Manipulator for Automatic Test Equipment Test Head", #5,931,048, Aug. 3, 1999.
46) Mungovan, J.P. et. al. "IS Machine", # 5,938,809, August, 1999.
47) A. Slocum, "Method of and apparatus for substance processing with small opening gates actuated and controlled by large displacement members having fine surface finishing", #5,964,242, Oct. 1999
48) A. Slocum, D. Gessel, "Semiconductor chip tray with rolling contact retention mechanism", #5,971,156, Oct. 26, 1999
49) N. Kane, A. Slocum, "Modular Hydrostatic Bearing with Carriage Form-Fit to Profile Rail", #5,971,614, Oct. 1999
50) A, Slocum; Alexander, R. Ziegenhagen, R. Richard, "Small contactor for test probes, chip packaging and the like", # 5,973,394, Oct. 26, 1999
51) M. Chiu, D., Levy, A. Slocum, "Interface Apparatus for Automatic Test Equipment With Positioning Modules Incorporating Kinematic Surfaces", #5,982,182, Nov, 1999
52) A. Slocum, "Method of Manufacturing Ball Grid Arrays for Improved Testability", #5,924,003, July 13, 1999
53) A. Slocum, L. Muller, "Integrated Prober, Handler, and Tester for Semiconductor Applications", 6,024, 526, Feb. 2000

54) A. Pfahnl, A. Slocum, J. Lienhard, "Heat-transfer enhancing features for semiconductor carriers and devices", #6,036,023, March 14, 2000
55) A. Slocum, M. Chiu, "Interface Apparatus for Automatic test Equipment ", #6,104,202, August, 2000
56) A. Slocum, "System to Simultaneously Test Trays of Integrated Circuit Packages", #6,097,201, August 2000.
57) A. Slocum, "Linear motion carriage system and method with bearings preloaded by inclined linear motor with high attractive force", #6,150,740, Nov., 2000
58) M. Culpepper, A. Slocum, "Quasi-Kinematic Coupling and Method for Use in Assembling and Locating Mechanical Components and the Like", # 6,193,430, Feb. 2001
59) A. Slocum, K. Wasson, "Damped tool holder and method", #6,280,126, Aug, 2001
60) T. Brogardh, H. Jerrerd, A. Robertson, A. Slocum, P. Willoughby, "Device and a method for calibration of an industrial robot", #6,418,774, July 2002
61) A. Slocum, "Single carriage robotic monorail material transfer system", 6,446,560, Sept. 10, 2002
62) A. Slocum, A. Pfahnl, E. Walker, R. Sartschev, "Temperature control structure", #6,448,575, September 10, 2002
63) A. Slocum, "Robust, small scale electrical contactor", #6,497,581, Dec. 24, 2002.
64) S. Awtar, A. Slocum, "Apparatus Having Motion with Pre-Determined Degrees of Freedom", #6,699,183, Feb. 10, 2004
65) S. Longson, A. Slocum "Wafer Level Contactor", #6,768,331, July 27, 2004.
66) J. Cherng, M. Cima, J. Gonzalez-Zugasti, N. Kane, A. Lemmo, C. Moore, A. Slocum, "Method and apparatus for manipulating and measuring solids"
67) J. Qiu, A. Slocum, J. Lang, R. Struempler, M. Brenner, J. Li, "Bistable Actuation techniques, Mechanisms, and Applications", # 6,911,891, June 28, 2005
68) A.H. Slocum, S. Awtar, A.J. Hart. "Material Transportation System", U.S. Patent 6,886,651, May 3, 2005.
69) A.H., Slocum. J. Lang, J. R. White; H. Ma, X. Yang, "Variable electronic circuit component" 6,914,785, July 5, 2005
70) A.H. Slocum, "Flexible Connector", US Patent 7,040,949, May 9, 2006.
71) A.H. Slocum Jr., R. Gupta, S. Jones, A.H. Slocum, "Method and apparatus for characterizing the temporal resolution of an imaging device ", US Patent 7,863,897, Jan. 4, 2011.
72) About a dozen more misc. pending

17. Professional Registration: None.

18. Major New Products, Processes, Designs, or Systems:

- SEMI E57-1296 Kinematic Coupling Standard. I proposed to SEMI/Sematech a new standard for locating 300 mm wafer cassettes, and then led the formulation and implementation of the standard, which is now in use by all companies for 300 mm semiconductor wafer cassettes and interfaces
- OMAX Jet Machining Center (3 different models). See: www.omax.com.
- Weldon 1632 Gold Grinder
- International Machine Tool Show (IMTS:"Best of Show" award for development Weldon Machine Tool's 1632 Gold Cylindrical Grinder (it used Slocum's hydrostatic bearings and ShearDamper technology), Sept. 1994.
- ShieldBeam Contactor, manufactured by Teradyne, which won an R&D 100 Award for one of 100 best new technical products of the year, June 1997.
- K-Dock Kinematic Docking System, manufactured by Teradyne, which won an R&D 100 Award for one of 100 best new technical products of the year, June 1997.
- Executive Producer for inner-city kids' rap group Mental Block, their first CD entitled, "IF".
- Kinetrix, Inc. (a new startup I helped create) Apollo Semiconductor Device Sorter and Galileo Semiconductor Device Handler

- Created web sites and programs for the Urban Design Corp (www.urbandesigncorp.org), and Paths-to-Peace (www.pathstopeace.org) to help teach kids to design and create and to promote better understanding between cultures.
- Advised 2nd Summer students as UROPs to pursue patenting their device "Ergonomic Cleaning Apparatus with Multiple Scrubbing Surfaces", US Patent # 5,915,869, June 1999.
- Worked with Overbeck Corp. of Long Island, NY to create the LT Grinding machine, which was featured as a cover article: "Get a Preload of This", American Machinist, December 2002.
- Executive Producer for "Journey of The Lost Souls" by Marc Graham (book of poems and rap CD)
- Dial Soap "Quest for the Best" consumer product search finalist for "Massagasoap"
- Massachusetts State Archives: Encasements for Documents of Freedom (cases to provide 20 years O_2 free enclosures to enable public viewing of original documents: Commonwealth of MA Charter of 1629, Charter of 1692, original copies provided to the 13 colonies of: US Declaration of Independence, Constitution, and Bill of Rights, all with combined value >$80 million)

19. Teaching Experience of Alexander H. Slocum

Term	Subject Number	Title	Role
ST 1986	1.965	Special Studies in Civil Engineering	Lect. in Charge
FT 1986	1.964	Design for Construction Automation*	Lect. in Charge
ST 1987	1.13	Design for Construction Automation*	Lect. in Charge
FT 1987	1.08	Introduction to Robotics*	Lect. in Charge
FT 1987	1.502A	Freshman Seminar "Design of Machine Systems"	Lect. in Charge
ST 1988	1.13	Design for Construction Automation*	Lect. in Charge
FT 1988	2.70	Introduction to Design	Recitation
FT 1988	1.S04	Fr Freshman Seminar "Precision Machine Design"	Lect. in Charge
ST 1989	2.996	Precision Machine Design*	Lect. in Charge
FT 1991	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1991	2.731	Advanced Engineering Design	Co-lecturer
ST 1992	2.732	Advanced Engineering Design	Co-lecturer
ST 1992	2.840	Precision Machine Design*	Lect. in Charge
FT 1992	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1992	2.731	Advanced Engineering Design	Co-lecturer
ST 1993	2.732	Advanced Engineering Design	Co-lecturer
ST 1993	2.75	Precision Machine Design*	Lect. in Charge
FT 1993	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1993	2.72	Machine Elements	Co-lecturer
ST 1994	2.75	Precision Machine Design*	Lect. in Charge
FT 1994	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1994	2.73	Design	Co-Lect. in Charge
ST 1995	2.70	Introduction to Design	Lect. in Charge
FT 1995	2A08	Freshman Seminar: Design of Toys & Games*	Lect. in Charge
FT 1995	2.75	Precision Machine Design*	Lect. in Charge
IAP 1996	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1996	2.70	Introduction to Design	Lect. in Charge
FT 1996	2A08	Freshman Seminar: Design of Toys & Games*	Lect. in Charge
FT 1996	2.75	Precision Machine Design*	Lect. in Charge
IAP 1997	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1997	2.007	Design & Mfg I*	Lect. in Charge
IAP 1998	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1998	2.75	Precision Machine Design*	Lect. in Charge
ST 1998	2.007	Design & Mfg I*	Lect. in Charge

FT 1998	2.009	Product Design Section Instructor	
IAP 1999	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1999	2.007	Design & Mfg I*	Lect. in Charge
IAP 2000	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2000	2.007	Design & Mfg I*	Lect. in Charge
ST 2000	2.75	Precision Machine Design*	Lect. in Charge
IAP 2001	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2001	2.007	Design & Mfg I*	Lect. in Charge
FT 2001	2.75	Precision Machine Design*	Lect. in Charge
FT 2001	2.997	(J with 6.963 Medical Innovation)	Co-Lect. in Charge
IAP 2002	2.971	2nd Summer Intro. to Design*	Lect. in Charge
IAP 2002	2.996	Paths to peace*	Lect. in Charge
ST 2002	2.007	Design & Mfg I*	Lect. in Charge
FT 2002	2.996	Paths to peace*	Lect. in Charge
IAP 2003	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2003	2.007	Design & Mfg I*	Lect. in Charge
FT 2003	SP247	8.01 Physics with Sports*	Lect. in Charge
FT 2003	2.75	Precision Machine Design*	Lect. in Charge
IAP 2004	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2004	2.007	Design & Mfg I*	Lect. in Charge
FT 2004	SP247	8.01 Physics with Sports*	Lect. in Charge
FT 2004	2.75	Precision Machine Design*	Lect. in Charge
IAP 2005	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2005	2.007	Design & Mfg I*	Lect. in Charge
FT 2005	2.75	Precision Machine Design*	Lect. in Charge
ST 2006	2.007	Design & Mfg I*	Lect. in Charge
FT 2006	2.75	Precision Machine Design*	Lect. in Charge
ST 2007	2.007	Design & Mfg I*	Lect. in Charge
ST 2008	2.007	Design & Mfg I*	Lect. in Charge
FT 2008	2.75/2.750	Precision Machine Design*	Lect. in Charge
ST 2009	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2009	2.75/2.750	Precision Machine Design*	Lect. in Charge
FT2009	2.A38	Freshman Advisor Seminar*	Lect. in Charge
ST 2010	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2010	2.75/2.750	Precision Machine Design*	Lect. in Charge
FT2010	2.A38	Freshman Advisor Seminar*	Lect. in Charge

* Indicates subject developed by Slocum

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   2) Handbook of Human-centered Design (Japanese), Section 7.3
   2) Slocum, A. H., FUN*da*MENTALS of Design, available on-line for free at (http://pergatory.mit.edu/2.007/resources/FUNdaMENTALS.html)

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136) D. Da. Pozzo, M. Deterre, D. Eggenspieler, M. Lobovsky, A.H. Slocum, Frank Pigula, "Hydraulic Remotely Adjustable Pulmonary Artery Banding", Proceedings of the 2010 Design of Medical Devices Conference, DMD2010, April 13-15, 2010, Minneapolis, MN, USA.

137) Y. Chen, J. H. Chang, A. S. Greenlee, K. C. Cheung, A. H. Slocum, R. Gupta, "Multi-turn, Tension-stiffening Catheter Navigation System", ICRA'10, Anchorage, Alaska, USA.

138) A. H. Slocum, Jr., S. C. Duffley, J Moreu Gamazo1, A. Watrall, J.E. Spiegel, A. H Slocum, "Design of a Pressure Measuring Syringe", Proceedings of the 2010 Design of Medical Devices Conference, DMD2010, April 13-15, 2010, Minneapolis, MN, USA.

139) J.E. Petrzelka, D.M. Chatzigeorgiou, M.C. Menon, M.E. Lustrino, C.J. Stefanov-Wagner, A.H. Slocum, S.K. Agarwal, 2001, An Articualting Tool For Endoscopic Screw Delivery, Proceedings of the 2010 Design of Medical Devices Conference, April 13-15, 2010, Minneapolis, MN, USA.

140) S.J. Anderson, J.C. Zimmermann, E.F. Houston, K.M. Farino, N.D. Begg, , Design of an Endoscopic Lens Shielding Device for use in Laparoscopic Procedures, Proceedings of the 2010 Design of Medical Devices Conference, Minneapolis, MN, USA, Mar. 13-15, DMD2010-3849.

141) M. Read, R. Martens, J, Lang, and A. Slocum, "The Effects of Contact Radius and Scrub on Thin Film Contacts," Proc. of 56th IEEE Holm Conference on Electrical Contacts, Charleston, 2010.

142) D.S. Codd, A.H. Slocum, "Direct Absorption Volumetric Molten Salt Receiver With Integral Storage", Proceedings of ASME 2011 5th International Conference on Energy Sustainability & 9th Fuel Cell Science, Engineering and Technology Conference, ESFuelCell2011, August 7-10, 2011, Washington, DC, USA

143) *G. Rothenhöfer, A. Slocum, M. Paone, X. Lu, A. Yui, "Elements for the Design of Next Generation, High Stiffness and High Accuracy Precision Machines", 2011 euspen annual mtg, Como, Italy

144) *A. Slocum, R. Campbell, S. Ziegehgaen, W. Miskoe, D. V. Lorenzo Ippolito, N. De Blasio,, "Design, Fabrication, and Testing of a Modular Concentrated Solar Power Trough System", 2011 euspen annual mtg, Como, Italy

145) O. Yaglioglu, R Martens, A. Cao, A. H. Slocum, "CNT-Metal Contact Structures", to be presented at Proc. of 57th IEEE Holm Conference on Electrical Contacts

146) Walsh, C., Slocum, A.H., "Design of a Telerobot for Percutaneous Instrument Distal Tip Repositioning", 33rd Annual International Conference of the IEEE Engineering in

Medicine and Biology Society (EMBC'11) to be held in Boston Marriott Copley Place, Boston, MA, USA on August 30 - September 3, 2011.

147) Zurovcik, D., Slocum, A.H., "Development of Simplified Negative Pressure Wound Therapy Device for Low-Resource Settings", 2011 IEEE Global Humanitarian Technology Conference.

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*Outgrowth of supervised student research.

4. Other Major Publications:

   1) Slocum, A. H., (Executive Producer) for inner-city kids' rap group Mental Block, their first CD entitled "IF".
   2) Slocum, A. H., (Executive Editor) for Marc Graham's book of poems and images entitled "JoTLS" (Journey of The Lost Souls) www.jotls.com .

5. Internal Memoranda and Progress Reports:

   None

6. Invited Lectures:

   1. April 1986, "Flexible Automated Fixturing Systems," SME Conf. on Jigs and Fixtures, Cincinnati, OH.
   2. Dec. 1986, "A Five Axis Robotic Micromanipulator," ASME Winter Annual Meeting, Anaheim, California.
   3. Dec. 1986 "A Servo-Controlled Pneumatic Double Gripper with Changeable Fingers," ASME Winter Annual Meeting, Anaheim, CA.
   4. Sept. 1989, *Precision Machine Design,* Short course for the American Society for Precision Engineering Annual Meeting in Monetary, CA.
   5. Sept. 1990, *Precision Machine Design,* Short course for the American Society for Precision Engineering Annual Meeting in Rochester, NY.
   6. Oct. 1991, *Precision Linear Motion Bearing Design,* Short course for the American Society for Precision Engineering Meeting in Santa Fe, NM.
   7. Oct. 1991, *Error Budgeting and Machine Modeling,* Short course for the American Society for Precision Engineering Meeting in Santa Fe, NM.
   8. Oct. 1992, *Actuators for Precision Machines,* Short course for the American Society for Precision Engineering Meeting in Orlando, FL.
   9. Oct. 1992, *Applications of Ceramic Materials in Precision Machines,* Short course for the American Society for Precision Engineering Meeting in Orlando, FL.
   10. Nov. 1993, *Actuators for Precision Machines,* Short course for the American Society for Precision Engineering Meeting in Seattle, WA.
   11. Nov. 1993, *Applications of Ceramic Materials in Precision Machines,* Short course for the American Society for Precision Engineering Meeting in Seattle, WA.
   12. Nov. 1993, *Design of Damping Systems for High Precision Machines,* Short course for the American Society for Precision Engineering Meeting in Seattle, WA.
   13. Nov. 1994, *Actuators for Precision Machines,* Short course for the American Society for Precision Engineering Meeting in Cincinnati, OH.

14. Nov. 1995, *Actuators for Precision Machines,* Short course for the American Society for Precision Engineering Meeting in Phoenix, AZ.
15. Oct, 2000, *Getting Students Psyched about Engineering and Science*, Robofesta Conf., Osaka, Japan
16. Nov. 2000, *Advances in Machine Tool Design*, ASME Winter Annual Meeting, Orlando, FL
17. July 2001, *Advances in Machine Elements*, keynote address, 10 International Conference on Precision Engineering, Yokohama, Japan.
18. Nov. 2002, *Mechanics of Designing Precision Machines*, Harvard University, Division of Engineering and Applied Science Dept. seminar
19. April. 2003, *The Nanogate*, Harvard University, Division of Engineering and Applied Science Dept. seminar
20. June 2003, *Characterization and Fabrication of the NanoGate for Nanoscale Fluidics, Wireless Communications, and ?,* NSF Workshop on Nanoscale Mechanical Engineering, Arlington, VA Nov. 2002
21. Nov. 2003, *Advances in Precision Machine Design*, keynote speaker, Mechatronics, Automation and Control Symposium of the COBEM 2003 Sao Paulo Brazil
22. Nov. 20, 2003, "Fundamentals of MEMS machines", Invited lecture, University of Florida
23. March 22, 2004, "Fundamentals of Precision Machine Design", invited lecture, Brigham Young University
24. March 22, 2004, "Applying Macro Machine Design Experience to Dinky Designs", invited lecture, Brigham Young University
25. May 17, 2004, "Fundamentals of Precision Machine Design", invited lecture, Ohio State University
26. June 2, 2004, "Magnetically Preloaded Friction Drive System", Invited keynote speaker, European Union Society for Precision Engineering & Nanotechnology annual meeting.
27. Sept. 6, 2004, "A design Environment to Teach Students about Optimal Transmission Ratios", 4th. Intl. Conf. Advanced Engineering Design, Glasgow, Scotland, Sept. 5-8, 2004.
28. Sept 14, 2006, "Design of Small Precision Machines", ICOMM Univ. of Illinois UC, keynote address:
29. Oct. 16, 2007, "Water Hydrostatic Bearings for Precision Machine Tools and Industrial Machinery", invited talk, ASPE Annual Mtg
30. April 14, 2008 "A Fantasy Vision of how as a Giant Bio Nano Team We All Zoom Forward to Infinity and Beyond" , 2008 Bio-Nano Manufacturing Grand Challenges for 2020 Workshop, Arlington, VA
31. Oct 21, 2010, "Precision Machines for Renewable Energy Harvesting and Storage", First IFToMM Asian Conference on Mechanism and Machine Science, Taipei, Taiwan.

Theses Supervised by Alexander H. Slocum

	Total	Completed	In Progress
S.B.	105	105	0
S.M.	52	48	4
Engineers	1	1	0
Doctoral Supervisor:	45	43	2
Doctoral Reader (committee member):	29	28	1

S.B. Theses:

1. Robinson, Darryl K., "Design of a Prototype Fastening System for the Trackbot Automated Construction Robot," May 1986.
2. Kang, Jiin, "Design of a Track Positioning Mechanism for an Interior Wall Construction Robot," June 1986.

3. Paulson, Bruce A., "Design of a Materials Handling System to Automate Interior Wall Construction," June 1986.
4. Thackston, III, George W., "Design of an Automatically Guided Vehicle for Use in Automated Drywall Construction," June 1986.
5. Gladwin, S. C., "Design and Assembly of a Construction Robot Subsystem to Fasten Drywall to Studs," June 1986.
6. Shiller, Andrew., "Kinematic Analysis of A Precision Slide," June 1987.
7. Gregory, Arthur, "Vacuum Gripper Design for Automated Assembly,", June 1987.
8. Wurman, Peter, "Anechoic Chamber Design and Acoustical Analysis of Room 1-051," June 1987.
9. Heatzig, Eric, "Scafbot-A Servo Controlled Scaffolding Device," June 1987.
10. Huang, Stanley, "Design and Implementation of a Software Controller for a Wall Building Robot,"June 1987, (Electrical Engineering and Computer Science).
11. Barrientos, Miguel, June 1993, "Tools for Developing Countries".
12. Mateo, Evan, "Semiconductor Wafer Gripper", June 1994.
13. Phillips, Alton, "Electrostatic Air Cleaner", June 1994.
14. Breinlinger, Keith J., "A Handbook to show 2.007 Students How to Better Utilize the Materials in the 2.007 Kit, " February 1996
15. Percer, Adrian C., "2.007 Briggs and Stratton Lawnmower Engine Exercise, " June 1996
16. Estan, Basak, "Modeling Methods Using Computer Aided Design, " June 1996.
17. Shull, Craig M., "Fundamentals of the 2.007 Design Process, " June 2006
18. Goldstein, Evan D., "The Design Process as Employed in the Introduction to Design Class at MIT, " June 2006.
19. Hicks, Robert J., "A Proposal for the 2.007 Book: Instrument to Design, " February 1997
20. Youngbear, Kathy, "Optimization of Cross-Sectional Configuration of an Extruded Plastic Truss, " June 1997.
21. Richkus, Rebecca, "Performance Limiters in the Clamping Mechanism of Injection Molding Machine, " June 1997.
22. Schmidt-Lang, Michael P., "The Design of a Simple Wind Tunnel Test Stand for Measuring Lift to Drag Ratio, " June 1997.
23. Pellegrini, Brian J., "Guide to the Design Process through the MIT 2.70 Contest, " June 1997.
24. Melvin, Jason W., "Design of a Kinematic Coupling for Machine Tool Fixturing, " June 1997.
25. Lehman, David M., "The Design Process: MIT 2.70 Contest, " June 1997.
26. Burn III, Robert D., "Simulator Chair Design: Ergonomics and Vibration, "June 1997.
27. Shah, Raj, "Creation of a Website for the Purposes of Archiving Course-Related Material," June 1997.
28. Allen, Holly, "Multimedia as a Teaching Tool in 2.007, " June 1998.
29. Miller, John, "Design of an Anti-Backlash Transmission for Position Control Applications, " June 1998.
30. Butville, Michael, "Driveshaft Design for a Dynamometer Utilizing Rotary Motion Flexural Bearings, " June, 1998.
31. Durant, Lawrence C., "Administration of the Urban Design Corp. and the Implementation of Design in Hip Hop Production, " February 1999.
32. Prieto, Rodrigo, "2.007 Contest Design and Machine Design, " June 1999.
33. Cooperman, Seth J., "The History, Mechanics, and Psychology of Magic, " June 1999.
34. Cortesi, Roger S., "Designing a Mechanical Engineering Contest, " June 1999.
35. Sprunt, Alexander D., "A Three Axis CNC Router Design, " February 2000.
36. Breinlinger, Joshua E., "Design and Construction of a Linear Induction Powered LEGO Roller Coaster, " June 2006
37. Fuertes, Amilcar, "Read and Do with the Animaroos, " June 2006.
38. Davis, Wallace B., "Design and Cost Optimization of a Cast Concrete Constrained Layer Vibration Damper, " September 2000

39. Loiselle, Phillip J., "Thermal Stability of Kinematically Coupled Microscope Stack Structure, " June 2001
40. Moon, Daniel K., "Flexure Based Mounts for Sensitive Payloads: A Management and Engineering Stack Study (Course 2B), " June 2001
41. Harper, Christopher, "Resdesign of Industrial Pin Joint Test Apparatus, " June 2001
42. Chouinard, Natalie, "Design Process of a 2.007 Design and Manufacturing Contest Table, " June 2001
43. Arguelles, David, "Design and Manufacture of a BattleBot, " June 2001
44. Sanchez, Manuel A., "Planteez Business Plan and Preliminary Research, " June 2001
45. Kisai, Darul "Mechanical Design of Chassis and Drivetrain for an Autonomous Mobile Robot, "June 2001
46. Montgomery, Sean J., "An Analysis of the Dynamics of the 2001 2.007 Contest Table with an Overview of its Application to Table Design Choice, " June 2001
47. Harper, Kelly, "Redesign of Industrial Pin Joint Test Apparatus, " June 2001
48. Shur, Maiya, "Design and Manufacturing of a Device Prototype for Performing Combined Ultrasound and X-Ray Mammography, " June 2002
49. Bernstein, Oren, "Wireless Touch Pads for Competitive Swimming, "June 2002
50. Bravard, Marjory A., "Design and Implementation of an Electrical System for a Combined Ultrasound and X-ray Mammography Breast Imaging Device, " June 2002
51. Ferguson, Kevin M., "Design and Fabrication of the Testing Apparatus for the Characterization of the Z-axis Flexure in the MIT-PERG/UIUC-LFD High-Precision Microscope Project, " June 2002
52. Praster, Stephanie M., "Prototype Development of Linear Actuator System to Enable Breast Ultrasound, " September 2002
53. Roberts, Michael H., Approximation of Air Bearings as Linear Point Springs: Verification of an Analytical Model for a New Five-Axis Machine Tool", June 2002
54. Bloomsburgh, John G., "Sealing and Heat Transfer Analysis of Gas Flow through Alumina Tubes in a Tube Furnace, " June 2003.
55. Jacobs, Alex T., "Development of a Right-Angle Gearbox Design Module for Use in Undergraduate Mechanical Design Curriculum, " June 2003
56. Varady, Eric J., "Design and Manufacture of the 2003 2.007 Wireless Control Boxes, " February 2004.
57. Browne, Courtney, "Design of a 2.007 machine with All-Terrain Suspension, " June 2004.
58. Read, Melissa, "Designing a Better Hair Straightener, " June 2004
59. Kahn, Christopher, "Solution for Modular Die-Level Anodic Bonder, "June 2004.
60. James, Richard, "Design of an Alumnium Differential Housing and Driveline Component for High Performance Application Abstract, " June 2004.
61. Figueroa, Victor A., "Designing a Mechanism to Cleave Silicon Wafers, "September 2004.
62. Mukaddam, Kabir, "Design of a Silicon Wafer Fracturing Instrument, " February 2005.
63. Gomez III, Nicasio, "PCV Valve Flutter: Vibration Characterization through Pressure and Flow, "June 2005
64. Held, David, "Modeling and Control of a Silicon Substrate Heater for Carbon Nanotube Growth Experiments, " June 2005.
65. Fonder, Gregory Paul, "The Back Stroke Buddy, "June 2005
66. Bonas, Calvin, "Re-Usability of Plastics, " June 2005
67. Jonnalagadda, Aparna S., "Passive Microfluidic Interconnects, "June 2005
68. Shu, Yuan, "Tabletop Robot to Aid in Arm Rehabilitation of Stroke Patients, "June 2005
69. Su, Benjamin W, "Wheelchair Exercise Roller Product Design, " June 2005
70. Johnson, Philip Tyler, "Development and Design of an Adjustable Elastic Support System for Ensuring Safety While Learning Physical Skills, "June 2005
71. Nelson, Alexandra T., "Press Fit Design: Force and Torque Testing of Steel Dowel Pins in Brass and Nylon Samples, "June 2005.
72. Trangle, Etan S., "SmartBat: A Baseball Swing Analysis and Training Product, "June 2005.

73. Smith, Benjamin D., "HandSkates: An Apparatus for physically Intelligent Exercise, " June 2005.
74. McKenney, "The Design and Development of Aquatic Exercise Shoe Flags, "June 2005.
75. Hatton, Ross L, "Plant Design for Deterministic Control of STEMs and Tape-Springs," June 2005.
76. Lin, Wey-Jiun, "Product Realization of the 2 007 Control Box, " June 2006
77. Yang, Tiffany, "The Wall-Mill: The Design of a Flexible Machine for the In-Situe Architectural Machining of Surfaces, "June 2006.
78. Tsai, Helan, "Swimming Fins for Strengthening the Inner Quadriceps Muscle", June 2007
79. Juan Herrera, "Wall Miller", June 2007
80. Colton, Shane, "Energy harvesting power electronics", June 2008
81. Bosworth, Will, "Adjustable Kinematic Coupling", June 2008
82. Schroll, Gregory, "Gyroscope Actuated Spherical Robot", June 2008
83. Treadway, Shane, "Climbing knot fixture", June 2008
84. Harrington, Jeremy, "Steerab le Catheter", June 2009
85. Paxton, Adam, "Air Window over Salt Reciever", June 2009
86. Gil Amrita, "Multi Loop Heat Exchanger for Molten Salts", June 2009
87. Koniski , Cyril, "Precision 4-Bar linkages", June 2009
88. Nikandrou, Paul, " Dynamic Valuation Model For Wind Development In Regard to Land Value, Proximity to Transmission Lines, and Capacity Factor":, June 2009
89. Houston, Emily, "Design of an Endoscope Lens Shielding Device for Use in Laparoscopic Procedures", June 2010
90. Lampe, Evan M, "Design of an Endoscope Lens Shielding Device for Use in Laparoscopic Procedures", June 2010
91. Schantz,Jarred L, "Design of an Endoscope Lens Shielding Device for Use in Laparoscopic Procedures", June 2010
92. Adames, Adrian, "Design Considerations of a 15KW Heat Exchanger for the CSPonD Project"
93. Chen, Xuefeng, "Instrument Guide for MRI-guided Percutaneous Interventions", June 2010
94. Ding, Hao, "Characterization of a Pre-curved Stylet Distal Tip Manipulation Mechanism for use in Volume Targeting", June 2010
95. Esmail, Adnan M, "Cannabis Sativa: An Optimization Study for ROI", June 2010
96. Powelson, Stephen K, "Developing a Low-Cost Ventilator", June 2010
97. Rodriguez Alvarado, Juan F, "Validation of a Numerical Model for the Analysis of Thermal-Fluid Behavior in a Solar Concentrator Vessel", June 2010
98. Racz, Rastislav , "Design of Bicycle Testing Rig", June 2010
99. Cervantes , Thomas Michael, "Analysis and Design of an Adjustable Bone Plate for Mandibular Fixation", June 2011
100. O'Rourke, Conor Rakis, "Mechanical Development of the Mounting and Actuation System of a Parabolic Solar Trough", June 2011
101. Westwood, Mitchell, "Creation and Validation of a Numerical Model for the Analysis of Bending Patterns of a Flexural Laparoscopic Grasper", June 2011
102. Hawthorne, Stephan, "Device for the Mechanization of Corneal Transplants", June 2011
103. Marten-Ellis Graves, Carmen, "Drive Train Improvements and Performance Evaluation of a Robotically Steered Needle", June 2011
104. Reyda, Caitlin J., "Design of a Pressure Sensing Laparoscopic Grasper", June 2011
105. Rees, Jennifer, "Modeling the Solar Thermal Receiver for the CSPonD Project", June 2011

S.M. Theses:

1) Hou, William M., "Conceptual Design of an Automated System for Emplacement and Retrieval of Nuclear Waste," January 1987.
2) Schena, Bruce, "Design Methodology for Large Work Volume Robotic Manipulators: Theory and Application," Sept. 1987.
3) Gedney, Richard, "Sensor and Control System Design for Automated Testing of Structural Materials," January 1988.

4) Damazo, Bradford, "Mechanical, Sensor, and Control System Design of an Accelerometer Calibrator with One Part Per Million Accuracy," January 1988.
5) Ousterhout, Karl, "Design of a Force and Position Servo Controlled Robotic Gripper with a 50:1 Grip Force to Weight Ratio," January 1988.
6) Levy, David, "Studbot: A Construction Robot for the Automated Assembly of Steel-Stud Partition Walls," Sept. 1987.
7) ~~Ziegler, Andrew, "Studwelder: A Construction Robot~~ for In-Situ Automated Welding of Shear Studs," June 1988.
8) Heatzig, Eric, "Modular digital servo controller," June 1989 (Civil Engineering).
9) Carey, John, "Methodologies of Controller Design for Precision Linear Motion Systems," June 1992.
10) Gaub, Heinz, "Hydrostatic Linear Motion Bearings for Precision Machine Tools," June 1992.
11) Schmeichen, Philip, "Design of Precision Kinematic Systems", Jan. 1993.
12) Bhathena, Firdaus, "Mapped Control Systems for Precision Machines" (Co-supervisor with Prof. Lang), June 1993.
13) Mintz, David, "Precision Measuring Systems", June 1993.
14) Smith, Michael, "Adaptive Control Systems for Precision Machines" (Co-supervisor with Prof. Annaswamy), June 1993.
15) Brünner, Christoph, "Self Compensating Hydrostatic Bearings for Grinding Machine Tables", January 1994.
16) Chiu, Michael, "Design of a Precision High Speed Tool Servo", January 1994.
17) Wasson, Kevin, "High Speed Hydrostatic Spindle Design" 1994.
18) Culpepper, Martin, "Design of Debris Cleaner Using a Compound Auger and Vacuum Pick Up", January 1997.
19) Scrivens, Jevin, "A Wireless Robot for Semiconductor Manufacturing Equipment", June, 1997.
20) Houdek, Phillip, "Design and Implementation Issues for Stewart Platform Configuration Machine Tools", June 1997.
21) Alden, John, "Active Kinematic Coupling", June 1997.
22) Ellahi, Farooq, "An Integrated Decanter Centrifuge-Pitot Pump", June 1997
23) Brienlinger, Keith, "Hexapod Home Flight Simulator", August 1998.
24) Balakrishnan, Asha, "Planarized Ball Grid Arrays", June 1999.
25) Schmidt-Lange, Michael, "A graduate level treatment of the design of a machine for the 1999 2.007 Contest,", June 1999.
26) Rohatgi, Gaurav, "Damped Tool Holder", Approaches for Chatter Reduction in Deep Cavity and Intricate Surface Milling, June 1998.
27) Cortesi, Roger, "An Easy to Manufacture Non-Contact Precision Linear Motion System and Its Applications", August 2000
28) Sprunt, Alex, "Electrical Contact tester", June 2002
29) Robertson, Alec, "Precision Aerostatic Spherical Joint", June 2003
30) Montgomery, Sean, "Electronics Curriculum for 2.007", June 2003
31) Werkmeister, Jaime, "Mesomill", June 2004
32) Thompson, Kate, "MEMS Fluid Coupling", June 2004
33) Abu-Ibrahim, Fadi, "Low-cost precision waterjet", June 2004
34) Vanderpoel, Timothy, "Design of a Snowboard Simulating Exercise Device", June 2005
35) Figueredo, Stacy, "Monolithic Plastic Biopsy Device", June 2006
36) Durand, Keith, "Design of an Energy Efficient and Economical Actuator for Automobile Windows", June 2007
37) Jonnalagadda, Aparna, "Automotive Energy Harvesting", Jan. 2007
38) Trimble, Zachary, "Rotating Energy Harvesting Device", June 2007
39) Rothenhofer, Gerald, "Hydrocline linear motion axis", June 2007
40) Zurovcik, Danielle, "Negative Pressure Wound Therapy Device", June 2007
41) Kuhn, David, "Desktop systems for manufacturing carbon nanotube films by chemical vapor deposition", June 2007

42) Sarah Edinger, "Multi Motion Door", Jan. 2008
43) Bassett, Erik, "Linear clutch for needle insertion", June 2008
44) Rogas, Folkers, "CSPonD Heat Exchanger", January 2011
45) Julia Zimmerman, "Single-use Lancet and Capillary Loading Mechanism for Complete Blood Count Point of Care Device, January 2011
46) Gregory Fennell, "Offshore Renewable Energy Storage System", June 2011
47) ~~William Bosworth, "Design and Parametric Simulation of~~ Radially Oriented Electromagnetic Actuators", June 2011
48) Nikolai Begg, "Bistable Flexure-based Trocar", June 2011
49) Wong, Anthony, "Water Hydrostatic Bearings for Ships"
50) Bridgers, Daniel, "Ex-Vivo Brain Holding Fixture for MRI Studies"
51) Rosario, Matthew, "Cardiac Lead Tester"
52) Meredith, James. "Offshore Energy Storage"

Engineer Degree

1) Werkmeister, Jaime, "Development of Silicon Insert Molded Plastic (SIMP)", June 2005

Doctoral Theses, Supervisor:

1) Demsetz, Laura, "Methodology for Formulating Designs of Task Specific Automated Construction Machinery", Jan. 1989. (Civil Engineering).
2) Everett, John, "Construction Automation: Basic Task Selection and Development of the Cranium", June 1991. (Civil Engineering).
3) Marsh, Eric, "Design of Precision Coordinate Measuring Machines", June 1994.
4) Van Doren, Matthew, "Precision Machine Design Methodology for Design of Semiconductor Processing Equipment", June 1995.
5) Seagnetti, Paul, "Design of Precision Grinding Machines for Ceramics", January 1996.
6) Ho, Chris, "Concurrent Development of a Rotationally-Symmetric Barb Joint for Modular Storage Systems through Product Innovation Research", June 1997.
7) Levy, David, "Portable Product Miniaturization and the Ergonomic Threshold", August 1997.
8) Braunstein, Daniel, "Precision Printed Circuit Board Manufacturing", August 1997.
9) Chiu, Michael, "High Precision Semiconductor Equipment Test Design", January 1998.
10) Nayfeh, Samir, "Design and Application of Damped Machine Elements", June, 1998.
11) Pfahnl, Andreas, "Design of Precision Temperature Controlled Precision Machine Tools", June 1998.
12) Hale, Layton, "Principles and Techniques for Designing Precision Machines ", January 1999
13) Hochmuth, Carsten, "Platform Concept for Precision Machining Centers", January 1999
14) Kiani, Sephir, "Multi-connection vias for printed circuit boards", January 1999.
15) Vallance, Ryan, "Precision Miniature Mechanism Manufacture", June 1999.
16) Muller, Luis, "Modular Semiconductor Test, Assembly & Packaging Manufacturing Equipment Design", June 1999.
17) Kane, Nathan, "Surface Self-Compensated Modular Linear Hydrostatic Bearings", June 1999.
18) Culpepper, Martin, "Design and Application of Compliant Quasi-Kinematic Couplings", January 2000.
19) Bamburg, Eberhard, "Principles of Rapid Machine Design", June, 2001.
20) O'Sullivan, Donald, "Structural Elements with Mathematically Defined Surfaces for Enhanced Structural and Acoustic Performance", August 2001.
21) White, James, "The Nanogate: Nanoscale Flow Control", June 2003.
22) Qiu, Jin, "An Electrothermally-Actuated Bistable MEMS Relay for Power Applications", June., 2003.
23) Brienlinger, Keith, "Three Dimensional Routed Manifolds with Externally Inserted Cables", June, 2003.
24) Sihler, Joachim, "A Low Leakage 3-Way Silicon Microvalve", January 2004

25) Awtar, Shorya, "Synthesis and Analysis of Parallel Kinematic XY Flexure Mechanisms", January 2004
26) Li, Jian, "Electrostatic Zipping Actuators and Their Application to MEMS", January 2004
27) Pat Willoughby, "Elastically Averaged Precision Alignment", June 2005
28) Sprunt, Alexander, "A Variable Capacitor Made from Single Crystal Silicon Fracture Surface Pairs", August 2005
29) ~~Yang, Xueen, "MEMS LC Tunable Filter", June 2005~~
30) Graham, Marc, "Product Development by Deterministic Design", June 2006
31) Hart, Anastassios John, "Continuous Growth Nanotubes", August 2006
32) Thompson, Mary Kate, "A Multi-Scale Iterative Approach for Finite Element Modeling of Thermal Contact Resistance", August 2007
33) Yaglioglu, Onnik, "Carbon Nanotube Based Electromechanical Probes", June 2007
34) Ma, Hong, "Dielectric Spectroscopy", June 2007
35) Freeman, David, "Resonator PCV Valve", January 2008
36) Weber, Alexis, "MEMS KOH Relay", June 2008
37) Read, Melissa, "Design of a Standard Method and Instrumentation for the Measurement and Characterization of MEMS Fabricated Electrical Contacts", Jan., 2009
38) Walsh, Conor, "medical robot control system", June, 2010
39) Rothenhofer, Gerald, "Elements for the Design of Precision Machine Tools with High Required Loop Stiffness and their Application to a Prototype 450 mm Si-Wafer Grinder", August 2010
40) Durand, Keith, "Document Encasements", January 2011
41) A. Zachary Trimble, "Vibration Energy Harvesting", June, 2011
42) Figueredo, Stacy, "Parabolic Trough Solar Collectors: Design for Increasing Efficiency", June 2011
43) Codd, Danny, "Grazing Incidence Concentrated Soilar Power System", June 2011
44) Hanumara, Nevan, "Spherical mechanisms", work initiated Jan., 2007
45) Zurovcik, Danielle, "Negative Pressure Wound Therapy", June 2008

Doctoral Theses, Reader:

1) Bausch, John J. III, "Kinematic Methods for Automated Fixture Design", Jan. 1990.
2) Trumper, Dave, "Magnetic Suspension Techniques for Precision Motion Control", Sept. 1990 (Electrical Engineering and Computer Science).
3) Chai, Jangbom, "Non-Invasive Diagnostics of Motor-Operated Valves", June 1993.
4) Mosleh, Mohsen, "The Role of Wear Particles in Geometrically Constrained Frictional Systems in Dry Sliding", June 1994.
6) Walczyk, Daniel, "A Complete Sheet Metal Forming System Incorporating a New Quick Protyping Method for Dies", January 1996.
7) Frey, Daniel, "Using Product Tolerances to Drive Manufacturing System Design", June 1997.
8) Williams, Mark, "Precision Six Degree of Freedom Magnetically-Levitated Photolithography Stage", October 1997.
9) Pfahnl, Andy, "Design of a Thermal Control System for an IC Test-In-Tray Handler", June 1998.
10) Ludwick, Stephen, "High-Speed Lens Cutting Machine", MIT, Mechanical Engineering, June, 1999.
11) Liebman, Michael, "Five-Axis Grinding Machine for Centimeter-scale Parts", MIT, Mechanical Engineering, June 2002.
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14) Hidrovo, Carlos, "Development of a Fluorescence Based Optical Diagnostics Technique and Investigation of Particle Ingestion and Accumulation in the Contact Region of Rotating Shaft Seals", Mechanical Engineering, June 2001.
15) Sujan, Vivek, "Compensating for Model Uncertainty in the Control of Cooperative Field Robots", June, Mechanical Engineering, 2002.

16) Konkola, Paul, "Phase Interference Gratings", Mechanical Engineering, June, 2003
17) Savran, Cagri, "A Robust Micromechanical Sensor for Label-free Biomolecular Detection in Real-time", Mechanical Engineering, Jan. 2004
18) Griffith, Saul, "Self Assembling 3D structures", Mechanical Engineering, June 2004
19) Kevin Turner, "Wafer Bonding: Mechanics-Based Models and Experiments", Mechanical Engineering, June 2004
20) Eric Wilhelm, "Printed Electronics and Micro-Electromechanical Systems", Mechanical Engineering, June 2004
21) Hai Ning, "Building E-Education Platforms For Design-Oriented Learning:, Civil Engineering, June 2004.
22) Sparks, Andrew, "Scanning Probe Microscopy With Inherent Disturbance Suppression Using Micromechanical Devices", Mechanical Engineering, Sept. 2004
23) Andrew Wilson, "Wafer Bonding", June 2004
24) Kripa Varanasi "Damping mechanisms", June 2004
25) Hashemi, Fardod, "Nanotweezers", June 2005
26) Rick Montesanti, "High speed tool servo", June 2006
27) Balakrishnan, Asha, "Development of Novel Dynamic Indentation Techniques for Soft Tissue Applications", August 2007
28) Winter, Amos, "burrowing robots", August 2010
29) Yamamoto, Namiko, "CNT reinforced composites", in progress

EXHIBIT B

Expert Witness History of Alex Slocum
Updated July 8, 2011

Plaintiff	Defendant	Year began	Expert Report for	Firm	Deposition	Trial	Result
THK Corp.	US Govt.	1992	Defendant	District Attorney of NY	yes	yes	Defendant prevailed
General Signal	Applied Materials	1994	Defendant	Weil, Gotshal & Manges LLP	yes	yes	Defendant prevailed
Reed	PowerScreen	1998	Plaintiff	Willcox, Pirozzolo & McCarthy	yes	yes	Plaintiff prevailed
Cytologix	Ventana	2001	Plaintiff	Willcox, Pirozzolo & McCarthy	yes	yes	Plaintiff prevailed
Karol	Burton Corp	2001	Defendant	Wolf, Greenfield & Sacks, P.C.	no	no	Case settled in defendant's favor
Donnelly	Reitter & Schefenacker	2002	Plaintiff	Weil, Gotshal & Manges	no	no	Case settled in Plaintiff's favor
Gillette & Braun	FTS and Daiwa	2003	Plaintiff	Fish & Neave	no	no	Case settled in Plaintiff's favor
Klingelberg	Gleason	2001	Defendant	Finnegan, Henderson, Farabow, Garret & Dunner, L.L.P.	no	no	Case settled in defendant's favor

Nikon	ASML	2003	Defendant	Hale and Dorr, L.L.P.	no	no	Plaintiff dropped the case wrt the patent on which I was the expert
Bayer	Abbott	2003	Plaintiff	Woodcock Washburn LLP	yes	no	Case settled in Plaintiff's favor
Tofasco	Atico	2003	Plaintiff	Kluger, Peretz, Kaplan, & Berlin	no	no	Case dropped
Westvaco	Finest	2005	Plaintiff	Weil, Gotshal & Manges	no	no	Case settled in Plaintiff's favor
Ryobi	Black & Decker	2004	Plaintiff	Brinks Hofer Gilson & Lione	yes	no	Case settled in Plaintiff's favor
LSI Industries, Inc and LSI Kentucky LLC	Imagepoint, Inc. and Marketing Displays, Inc.	2006	Defendant	McDermott Will & Emery LLP	yes	no	Summary judgment for defendant
Cytologix	Ventana	2005	Plaintiff	Kirkpatrick & Lockhart Nicholson Graham	no	no	Case settled in Plaintiff's favor
Cytologix	Ventana	2005	Plaintiff	Foley Hoag	no	no	Case settled in Plaintiff's favor
Canon, Inc.	GCC International, Inc.	2006	Defendant	Wolf, Greenfield & Sacks, P.C.	yes	no	Case settled in Plaintiff's favor
CalTech	Intuitive	2007	Plaintiff	SHORE CHAN BRAGALONE	no	no	Case settled in Plaintiff's favor

Intevac	UNAXIS USA INC.	2007	Defendant	Weil, Gotshal & Manges	yes	no	Case settled
LSI Industries, Inc and LSI Kentucky LLC	Imagepoint, Inc. and Marketing Displays, Inc.	2006	Defendant	McDermott Will & Emery	yes	no	Case settled
Canon, Inc.	GCC International Inc.	2006	Defendant	Wolf, Greenfield & Sacks, P.C.	yes	no	Case settled in Plaintiff's favor
Xerox	Media Science	2006	Defendant	Calvo & Clark, LLP, Wolf Greenfield	yes	no	Summary judgment for plaintiff
Keurig	Kraft	2008	Plaintiff	Wolf, Greenfield & Sacks, P.C.	yes	no	Case settled in Plaintiff's favor
Tyco	Bard	2009	Defendant	Weil, Gotshal & Manges	yes	no	Settlement pending (defendant's favor)
Millipore	Gore	2009	Plaintiff	Hamilton Brook Smith Reynolds	no	no	ongoing
Keurig	US PTO	2010	Plaintiff	Wolf, Greenfield & Sacks, P.C.	no	no	ongoing
Mitsubishi	GE	2011	Defendant	Weil, Gotshal & Manges	no	no	ongoing

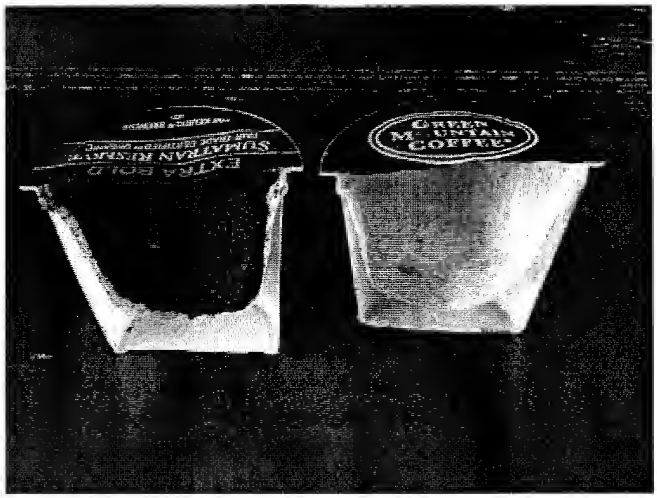
EXHIBIT C

EXHIBIT C

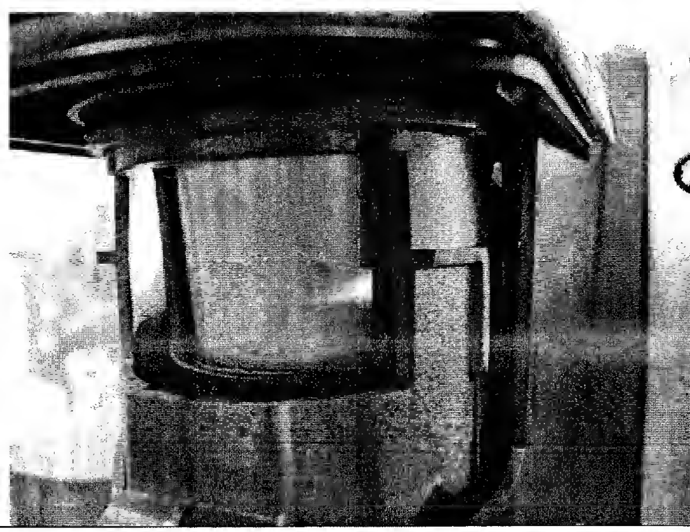
Claim Chart Confirming that Keurig's Current K-Cup Portion Pack Is a Commercial Embodiment of the Independent Claims in Keurig's '925 Application[17]

'925 Application Claims	Keurig's Current K-Cup Portion Pack
(Amended) Claim 1	
A beverage filter cartridge comprising:	The K-Cup portion pack is a cartridge with a filter that is used to prepare beverages.
a container having a container bottom and a container side wall extending upwardly from said bottom to a top opening;	The K-Cup portion pack has a bottom, a top with an opening (hidden by the cover in the below picture), and a vertical side wall that extends upward from bottom to top at a slight angle. 

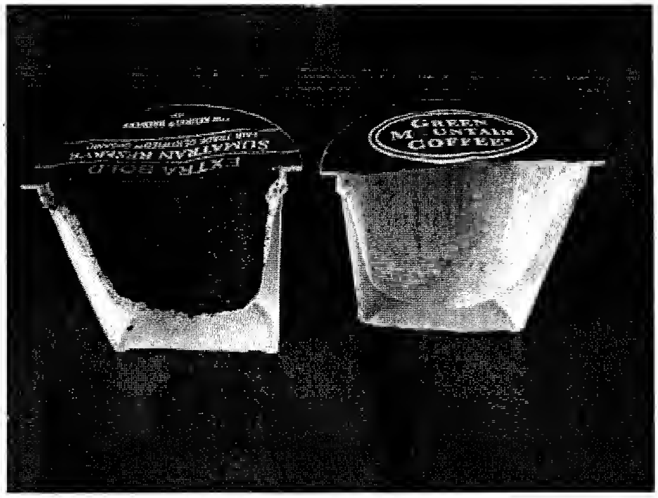
[17] The '925 claims in this table reflect the final amendments made in Keurig's December 5, 2006 reply to an Office Action. (K000823-834). My analysis is limited to whether the pending independent claims of the '925 patent application read on Keurig's existing commercial embodiment, which I understand has been sold since 2005. I have not considered whether other claims (e.g., dependent claims of the '925 application, or any claims in Sylvan) cover current Keurig K-Cup portion packs as well.

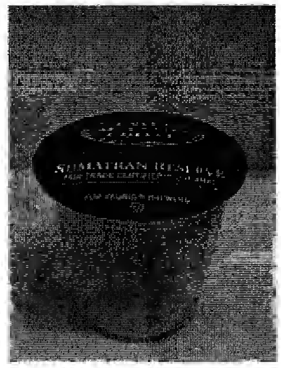
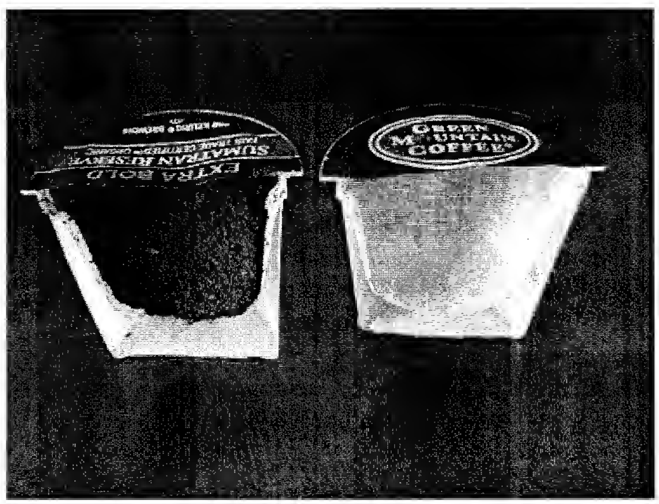
a filter element having a filter bottom and a filter side wall extending upwardly from said filter bottom, said filter element being received in said container and directly joined at a peripheral juncture to an interior of said container side wall, the interior of said container thus being subdivided by said filter element into a first chamber accessible via said top opening, and a second chamber, wherein pleats or flutes in said filter side wall form exit channels leading to said second chamber, and said exit channels are located between said container side wall and said filter side wall;	As illustrated by the cross-section view below, the K-Cup portion pack's filter is directly joined to the interior side wall of the top edge of the container:  The filter subdivides the container into two chambers. The first chamber (corresponding to the area largely filled with coffee grounds in the above picture) can be accessed by puncturing the cover that is attached to the top opening. The filter's pleats or flutes form exit channels that lead to the second chamber.
a beverage medium received in said first chamber via said top opening; and	The K-Cup portion pack's first chamber may be filled with ground coffee (as shown in the above picture), tea, or some other beverage medium.

<table>
<tr>
<td>a cover closing said top opening, said cover being piercable to admit liquid into said first chamber for contact with said beverage medium to produce a beverage,</td>
<td>The thin cover of the K-Cup portion pack is capable of being pierced by the brewer's injector needle. Once pierced, hot water is injected into the first chamber of the K-Cup, where it contacts the coffee or other beverage medium to extract soluble materials and thereby produce a beverage.

</td>
</tr>
<tr>
<td>said filter element being permeable to accommodate the flow therethrough of said beverage for delivery via said exit channels to said second chamber, and</td>
<td>Using replicas of the current K-Cup portion pack prepared at my request by Keurig, I was able to observe coffee permeate the fluted filter during the brew process and enter the second chamber through the exit channels visible below.
</td>
</tr>
</table>

said container bottom being piercable to accommodate an outflow of said beverage from said cartridge.	Keurig's brewers use an exit needle from below to pierce the bottom of the K-Cup portion pack to transfer the brewed coffee to a cup for consumption. 
(Amended) Claim 12	
A beverage filter cartridge comprising:	The K-Cup portion pack is a cartridge with a filter that is used to prepare beverages.
a container having a side wall and a bottom;	The K-Cup portion pack has a bottom and a vertical side wall that extends upward from bottom to top at a slight angle. 

a filter element having a side wall and a bottom, said filter element being arranged to subdivide the interior of said container into a first chamber inside said filter elcment and a second chamber located outside said filter element, said filter element being directly jointed to an interior of the container side wall at a peripheral juncture, and said filter sidewall having corrugations, having at least a portion that is permeable, and being arranged so that at least a portion of said filter side wall is spaced inwardly from and out of contact with said container side wall; and	As illustrated by the cross-section view below, the K-Cup portion pack's filter is directly joined to the interior side wall of the top edge of the container:  The filter subdivides the container into two chambers. The first chamber (illustrated below by the area largely filled with coffee grounds) is the area inside the filter. The filter is permeable and includes multiple corrugations. A gap separates the filter element from the container side wall. Even during brewing, the corrugations prevent portions of the filter from coming into contact with the container side wall.
a cover enclosing at least a portion of the first chamber.	As depicted in the above photographs, a cover seals the K-Cup portion pack's first chamber to ensure that the ground coffee retains its freshness.
(Amended) Claim 44	
A beverage filter cartridge comprising:	The K-Cup portion pack is a cartridge with a filter that is used to prepare beverages.

a container having a side wall and a bottom;	The K-Cup portion pack has a bottom and a vertical side wall that extends upward from bottom to top at a slight angle. 
a filter element having a side wall and a bottom, said filter element being arranged to subdivide the interior of said container into a first chamber inside said filter element and a second chamber located outside said filter element, said filter element being directly jointed to an interior of the container side wall at a peripheral juncture, and said filter sidewall having corrugations and being arranged so that at least a portion of said filter side wall is spaced inwardly from and out of contact with said container side wall; and	As illustrated by a cross-section view below, the K-Cup portion pack's filter is directly joined to the interior side wall of the top edge of the container:  The filter subdivides the container into two chambers. The first chamber (illustrated below by the area largely filled with coffee grounds) is the area inside the filter. The filter is permeable and includes multiple corrugations. A gap separates the filter element from the container side wall. Even during brewing, the corrugations prevent portions of the filter from coming into contact with the container side wall.

a cover enclosing at least a portion of the first chamber.	As depicted in the above photographs, a cover seals the K-Cup portion pack's first chamber to ensure that the ground coffee retains its freshness.

EXHIBIT D

May 3, 2011 testing at Keurig

Fluted K-cup tare	2.7 g
Conical K-Cup tare	3.0 g
Water TDS (ppm KCl)	115

(all TDS values below reflect the actual values recorded, prior subtraction of the 115 baseline)

Fluted production Sumatra, 12 g, 8 oz.

#	K-Cup wt (g)	Brew time (s)	Liquid wt (g)	TDS (ppm KCl)
1	14.6	39.2	207.8	1368
2	14.6	34.0	210.7	1317
3	14.4	36.8	212.3	1297

Fluted filter translucent Sumatra, 12 g, 8 oz.

#	K-Cup wt (g)	Brew time (s)	Liquid wt (g)	TDS (ppm KCl)
1	14.7	38.8	212	1370
2	14.7	34.8	211.2	1370
3	14.7	34.8	208.8	1369

Conical translucent Sumatra, 9.5 g, 8 oz.

#	K-Cup wt (g)	Brew time (s)	Liquid wt (g)	TDS (ppm KCl)
1	12.4	43.2	212.8	1100
2	12.4	30.8	215.1	1011
3	12.4	42.4	215.2	1086
4	12.4	30.0	212.2	1011
5	12.4	38.0	209.5	1109
6	12.4	31.6	212.7	1049
7	12.4	35.6	212.4	1038
8	12.4	35.6	213.1	1073
9	12.45	32.0	211.5	1076
10	12.5	32.0	215.2	1039

Fluted translucent Sumatra, 9.5 g, 8 oz.

#	K-Cup wt (g)	Brew time (s)	Liquid wt (g)	TDS (ppm KCl)
1	12.3	28.4	213.2	1023
2	12.3	30.0	211.8	1055
3	12.2	30.4	211.4	1068
4	12.3	28.8	215.9	1003
5	12.3	28.4	215.8	1002
6	12.3	28.4	214.7	1004
7	12.3	28.0	213.5	1005
8	12.2	27.2	213.6	1003
9	12.3	28.0	210.6	1011
10	12.3	28.4	216.4	1003

Fluted production Sumatra, 12 g, 12 oz.

#	K-Cup wt (g)	Brew time (s)	Liquid wt (g)	TDS (ppm KCl)
1	14.7	64.4	326.9	949
2	14.7	66.0	326.6	954
3	14.6	66.0	325.2	950

Conical Sumatra, 9.5 g, 12 oz.

#	K-Cup wt (g)	Brew time (s)	Liquid wt (g)	TDS (ppm KCl)
1	12.5	53.2	328.7	777
2	12.4	52.8	326.6	764
3	12.5	50.4	325.1	785